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Children and the wealth of nations

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Keywords
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Children and the Wealth of Nations

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Abstract

This paper uses calibrated versions of the Barro-Becker model to compute measures of well-being for 142 countries between 1970 and 2005. In the model, individuals are altruistic toward their descendants: they enjoy the well-being of their children. We derive a model based measure of effective "quantity of life," the effective life span of an individual. It depends positively on life expectancy, degree of altruism and number of children, and negatively on the rate of time discounting. Our calculations suggest a major quantity-quantity trade-off: for the period 1970-2005 the gains in quantity of life due to longevity improvements were mostly offset or overcome by the losses due to fertility reductions. Depending on the precise calibration, the effective quantity of life either remained roughly constant or fell substantially around the world. For many countries the effective growth rate of well-being, one that takes into account the quantity and quality of life, is significantly below the growth rate of per-capita GDP. Our findings challenge the wide-spread belief that development through fertility reductions is a free lunch.

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JEL classification: I10, I31, J17, O57

" ... who is loved more but our children, they are the prolongation of our existence..." *Lyrics of a classic Colombian song.*

1. Introduction

It is well-recognized that GDP per capita is an imperfect indicator of average economic welfare in a country. As a flow measure, GDP describes the material *quality* of life in a given period but it is silent about the *quantity* of life, the number of years over which the flow of income is enjoyed. Thus, even if two countries have identical GDP per capita, average welfare may differ due to differences in longevity. Recent works by Becker *et al.* (2005), Jones and Klenow (2011), and Cordoba and Ripoll (2012) calculate full measures of income that take into account longevity differences across countries and across time.

The quantity of life, however, is not only determined by the life span of an individual. Parents who perceive their children as extensions of their own life can increase their "effective" life span through the life of their children, grandchildren, etc. The idea that longevity and children are equivalent is embedded in the infinitely-lived model commonly used in macroeconomics. The model is often motivated by the idea that it really represents a dynasty, a sequence of finitely lived individuals who are linked by altruism. This idea is formalized by the Barro-Becker model of fertility (Becker and Barro 1988, and Barro and Becker 1989).

This paper uses quantitative versions of the Barro-Becker model to assess the welfare implications of fertility changes across time and space. The presumption that fertility may substantially affect welfare evaluations is based on two facts. First, as illustrated by Figures 1 and 2, fertility has changed substantially over time and fertility rates are very different across countries. Second, parents invest a significant fraction of their resources, wealth and time, on their children which suggests that children are a major source of happiness and welfare. For example, the U.S. Department of Agriculture estimates that the total present value of expenses on a child born in 2009 for a middle-income husband-wife family with two children is $\$226,920$ in 2010 dollars (USDA, 2010, page 23). This is only a partial figure because it only includes direct parental expenses made on children through age 17 such as housing, food, transportation, health care, clothing, child care, and private education, but excludes time costs and forgone earnings by parents, college costs and other costs after age 17.

To motivate the exercise, consider the One Child policy in China. The policy in motivated by the idea that controlling fertility helps eliminate poverty and alleviate social and environmental problems. Partly as a result of the policy, the total fertility rate dropped by 3.75 children between 1970 and 2005. During the same period, consumption per capita grew at an unparalleled rate of more than 5% per year, one of the largest in the world for the period. But is fertility control a welfare enhancing policy? After all, everything else equal, altruistic parents are better off by having more children. Is the observed consumption growth enough to compensate for the welfare loss due to lower fertility? This is the type of questions this paper seeks to answer.

The key concept of the paper is the *effective* quantity of life, a measure of the effective life span of an individual implied by the Barro-Becker model, one that combines both longevity and fertility. The core of the paper reports calculations for the effective quantity of life, as well as consumption equivalent measures of welfare, for various calibrated versions of the Barro-Becker model. A benchmark calibration uses the recent parameter estimates of Manuelli and Seshadri (2009) who identify the key parameters of the model by targeting macroeconomic statistics. We also provide an alternative calibration that matches plausible targets for the value of statistical life and the value of children. The key difference between the two resulting calibrations is that the benchmark places a strong weight on fertility and little weight on longevity while the alternative calibration places an intermediate weight on both. Our preferred calibration is the alternative but the benchmark also provides a plausible parameterization.

The following are the main findings. According to the benchmark model, while consumption per capita grew on average at an annual rate of 2.6% during the period 1970-2005 in a sample of 142 countries, welfare, measured in consumption equivalent units, grew only at an annual rate of 0.2%. This is because in the benchmark the effective quantity of life significantly decreased during the period due to the large drop in fertility rates while gains in life expectancy played only a secondary role. The alternative model, on the other hand, suggests that on average consumption growth is a good proxy for welfare growth, although there are many exceptions. The surprising result here is that welfare gains due to added longevity, of around 12 years on average, are mostly offset by welfare losses due to lower fertility, a loss of 2.6 children on average. According to the alternative model, the effective quantity of life remained roughly constant during the period 1970-2005, in spite of the large longevity gains.

The case of Asian miracles is particularly telling. According to the benchmark model, welfare growth in fast growing countries such as China, South Korea, Indonesia, Malaysia and Thailand was not higher than in the U.S. once the effect of fertility reductions is taken into account. The alternative model suggests that, on average for the full sample, welfare growth was similar to consumption growth because the large gains in longevity were offset by fertility losses. Individual cases may differ substantially. For China, for example, the alternative model suggests that welfare growth was below consumption growth by about 0.6% per year during the period 1970-2005.

This paper makes part of a growing literature that goes beyond GDP per capita as a measure of welfare. In addition to the papers already mentioned, this literature includes, among others: Cordoba and Verdier (2007), who consider inequality; Jones and Klenow (2011) who consider adjustments for life span, inequality, leisure and consumption; the Stiglitz Commission (see Stiglitz, Sen and Fitoussi, 2009) who consider a variety of adjustments. To the extent of our knowledge, this is the first paper to consider adjustments for fertility differences.

The remaining of the paper is organized as follows. Section 2 sets up the model, describes the benchmark calibration and the benchmark results. Section 3 reports robustness checks and results for an alternative calibration. Section 4 concludes.

2. The Baseline Exercise

This section describes a benchmark model of fertility that closely follows Becker and Barro (1988) and Barro and Becker (1989). The distinguishing feature of the model is that parents are altruistic: they enjoy the well-being of their descendants. We use the model to derive expressions for the effective quantity of life, the value of statistical life, the value of children, as well as consumption equivalent expressions of welfare. The benchmark calibration is that of Manuelli and Seshadri (2009). The key contribution of this section is to provide estimates for the effective quantity of life and measures of welfare across time and space.

2.1. The Model

A representative individual lives for T periods, consumes c per period and has n offsprings at age F. The lifetime utility of a particular individual is given by

$$V(c,n,T) = \sum_{t=0}^{T} \beta^t u(c) + \alpha \beta^F n^{1-\varepsilon} V'(c', n', T'), \tag{1}$$

where $u(\cdot) \geq 0$ is a per period utility function, β is a time discount factor, $V'(c', n', T')$ is the lifetime utility of a child, and $\alpha n^{1-\varepsilon}$ is the weight parents give to their n children, a weight that increases with the number of children but at a decreasing rate: $\alpha \geq 0$ and $0 \leq \varepsilon \leq 1$. This formulation is due to Becker and Barro (1988) and Barro and Becker (1989).

Consider now a steady state situation in which allocations and welfare are unchanged over time. In order for lifetime utility to be bounded, the restriction $1 > \alpha \beta^F n^{1-\varepsilon}$ is needed. This condition implies an upper bound for the number of children given by:

$$n_{\max} = \left(\frac{1}{\alpha\beta^F}\right)^{\frac{1}{1-\varepsilon}}. \tag{2}$$

In the quantitative exercises reported below we find that $n < n_{\max}$ for all countries.

In steady state, $V(c, n, T)$ can be solved from (1) as:

$$V(c, n, T) = u(c) \cdot Q(n, T), \tag{3}$$

where

$$Q(n, T) = \left[\frac{1-\beta^{T+1}}{1-\beta}\right]\left[\frac{1}{1-\alpha\beta^F n^{1-\varepsilon}}\right]. \tag{4}$$

Expression (3) states that lifetime welfare is the product of two terms. We denote them the quality and the *effective* quantity of life respectively. The quality of life is given by the utility flow, $u(c)$, while the effective quantity of life, $Q(n, T)$, is a positive function of the number of children and longevity. Notice that $Q(n, T)$ can also be written as $Q(n, T) = Q(T) \cdot Q(n)$ where

$$Q(T) = \frac{1-\beta^{T+1}}{1-\beta} = \sum_{t=0}^{T} \beta^t < T, \text{ and} \tag{5}$$

$$Q(n) = \frac{1}{1-\alpha\beta^F n^{1-\varepsilon}} = \sum_{t=0}^{\infty} \left(\alpha\beta^F n^{1-\varepsilon}\right)^t. \tag{6}$$

In this representation, $Q(T)$ is the *effective* life span of an individual, an interval smaller than T due to time discounting, and $Q(n)$ is the *effective* size of the dynasty, including the parent, from the parent's perspective. We use the word "effective" to distinguish it from the *actual* values of life span, T, and dynasty size, $1 + \sum_{i=1}^{\infty} n = \infty$. $Q(n)$ takes into account degree of altruism, age of fertility and actual number of children per parent. For example, if $F = 0$, $n = 1$ and $\alpha = 0.5$, the effective size of the dynasty is 2 even though the actual size is infinite. Finally, an equivalence between the infinitely-lived and the dynastic models can be obtained from (3) by either setting $T = \infty$ and $\alpha = 0$, or alternatively, by setting $T = 0$ and $\alpha = F = n = 1$. In both cases $Q(n,T) = \sum_{t=0}^{\infty} \beta^t$.

A useful shadow price is the implied willingness to substitute children for longevity:

$$\frac{\partial T}{\partial n} = \frac{\partial V/\partial n}{\partial V/\partial T} = \frac{\partial Q/\partial n}{\partial Q/\partial T} = -\frac{\beta^{-(T+1)} - 1}{\ln \beta} \frac{(1-\varepsilon)/n}{1/\left(\alpha \beta^F n^{1-\varepsilon}\right) - 1}. \tag{7}$$

In words, $\frac{\partial T}{\partial n}$ measures the value of one more child in all generations in terms of extra years of life for all generations. Notice that the value of a child in terms of life span, $\frac{\partial T}{\partial n}$, increases with T, decreases with n as long as $n \leq \overline{n}$, where

$$\overline{n} \equiv \left(\frac{\varepsilon}{\alpha \beta^F}\right)^{1/(1-\varepsilon)} < n_{\max}, \tag{8}$$

and $\lim_{n \to 0} \frac{\partial T}{\partial n} = \infty$.[1] The model thus predicts that the observed fall in fertility rates illustrated by Figures 1 and 2 have been particularly costly since they took place during a period of rising longevity. It also predicts that further reductions in fertility are increasingly costly and become unbearable as the number of children approaches zero.[2]

2.2. Welfare in Consumption Equivalent Units

Given specific functional forms, (3) can be used to calculate the welfare of an hypothetical representative individual in a given country at a given time using realized values of c, n and T. Moreover, by making the proper transformation, welfare can be expressed in terms of consumption equivalents. We now use (3) to define consumption equivalent measures of welfare. Let $[c_0, n_0, T_0]$ and $[c_i, n_i, T_i]$ be steady state allocations in two cases referred to as the baseline case

[1] In the Barro-Becker model the value of a child can increase with number of children if n is above a threshold level. This is due to the assumed functional form describing the weight that parents place on their children's welfare. Cordoba and Ripoll (2011) discuss this issue and consider alternative formulations that deliver strictly diminishing marginal utilities of children.

[2] Having zero children is never optimal in the Barro-Becker original formulation. Zero children could be optimal for alternative formulations of the altruism function. See Cordoba and Ripoll (2011).

and the alternative case respectively. For cross-country comparisons the subscripts refer to two different countries while for cross-time comparisons subscripts 0 and i refer to two different steady states for a given country. In the last case we are assuming that the country was in a steady state at time 0 but is in a different steady state at time i.

The ratio of consumptions, $\lambda_i(c) \equiv c_i/c_0$, is the typical way to describe relative welfare differences between both situations. $\lambda_i(c)$ describes only differences in quality but not quantity of life. A more comprehensive ratio of welfare, denoted λ_i, one that includes both differences in the quality and quantity of life can be defined as:

$$V(\lambda_i c_0, n_0, T_0) = V(c_i, n_i, T_i). \tag{9}$$

In words, λ_i is the proportional change in baseline consumption, c_0, needed to achieve the same welfare level of the alternative case. For example, $\lambda_i = 2$ means that twice as much consumption is needed. Notice that $\lambda_i = \lambda_i(c)$ if $n_0 = n_i$ and $T_0 = T_i$. It is informative to define two additional welfare ratios:

$$V(\lambda_i(n) c_0, n_0, T_0) = V(c_0, n_i, T_0); \tag{10}$$

$$V(\lambda_i(T) c_0, n_0, T_0) = V(c_0, n_0, T_i). \tag{11}$$

$\lambda_i(n)$ and $\lambda_i(T)$ measure the relative welfare gain or loss, in consumption equivalent units, of changes in fertility or life span respectively. For example, $\lambda_i(T) = 0.5$ means that the drop in life span, from T_0 to T_i, is equivalent to cutting baseline consumption by half. For completeness, notice that $\lambda_i(c)$ satisfies $V(\lambda(c)c_0, n_0, T_0) = V(c_i, n_0, T_0)$.

The following are the explicit solutions for the welfare ratios for the case $u(c) = c^\gamma$:

$$\lambda_i(c) = \frac{c_i}{c_0},\ \lambda_i(T) = \left[\frac{1-\beta^{T_i+1}}{1-\beta^{T_0+1}}\right]^{1/\gamma} \text{ and } \lambda_i(n) = \left[\frac{1-\alpha\beta^F n_0^{1-\varepsilon}}{1-\alpha\beta^F n_i^{1-\varepsilon}}\right]^{1/\gamma}. \tag{12}$$

Moreover, it is easy to check that λ_i satisfies:

$$\lambda_i = \lambda_i(c)\lambda_i(Q) \text{ where } \lambda_i(Q) \equiv \lambda_i(n)\lambda_i(T). \tag{13}$$

The last equation defines $\lambda_i(Q)$ which measures the proportional welfare change associated to changes in the effective quantity of life. For cross-time comparisons it is convenient to define welfare ratios in terms of annual growth rates as follows:

$$g(j) \equiv \frac{1}{i}\ln \lambda_i(j) \text{ for } j \in \{c, n, T, Q\} \text{ and } g = \frac{1}{i}\ln \lambda_i. \tag{14}$$

The welfare ratios just described are proportional shifts to baseline consumption, what Klenow and Jones (2010) call equivalent variations. Welfare ratios could also be defined as proportional shifts to consumption in the alternative case rather than baseline consumption, what Klenow and Jones call compensated variations. A compensated variation ratio is implicitly defined by the equation:

$$V(c_0, T_0, n_0) = V(c_i/\lambda_i, T_i, n_i).$$

Fortunately equivalent and compensated variations are identical in our set up due to the assumed functional forms, in particular additive separability and per-period power utility functions.

2.3. Data and Calibration

Data. Data for 142 countries for the period 1970-2005 was assembled using per-capita consumption data from the Penn World Table Version 7.0., and fertility and longevity data from the World Development Indicators. V is defined as the lifetime welfare of a newborn, n and T are set equal to the total fertility rate and life expectancy at birth respectively. Unless stated otherwise, 2005 prices are used.

Benchmark Calibration. Manuelli and Seshadri (2009), MS henceforth, have recently calibrated a version of the Barro-Becker model extended to include endogenous determination of life span. Since consumption, fertility and life span are endogenous in their model, their parameters are calibrated to properly take into account various trade-offs involved in the optimal choices of those variables. Moreover, their model is able to replicate key features of cross-country data regarding fertility, longevity, and income differences. In order to provide a tight discipline to our exercise, we adopt the MS calibration as our benchmark calibration. Since our formulation of preferences exactly match their formulation, we are left with no degrees of freedom to pick any additional parameter. Therefore, the results presented in this section come from an off-the-self Barro-Becker model and for a state-of-the-art calibration.

MS's functional forms and parameter values are the following: $u(c) = c^{\gamma}$, $\gamma = 0.38$, $\alpha = 0.8$, $\varepsilon = 0.35$, $\beta = 0.96$, and $F = 25$. MS estimate these and other parameters by matching targets for the U.S. and/or OECD countries. The crucial parameters α, ε and γ are identified as part of a larger system that includes as relevant targets a per-capita fertility rate of 1.05 (or a 2.1 fertility rate per women), a ratio of intergenerational transfers to GDP of 4.5%, and a capital-output ratio of 2.52. The parameter β is not estimated but set to a seemingly standard value.

MS defines n to be the total fertility rate divided by 2 but in our framework n is the total number of children.[3] To make the MS calibration consistent with our formulation all what is needed is to re-scale α by the factor $2^{\epsilon-1}$ so that n is the total number of children. The resulting α is 0.5, instead of 0.8. In summary, our baseline calibration uses MS's parameters but with two changes: $\alpha = 0.5$ and n is defined as the total fertility rate.[4] The corresponding values of $n_{\max}$ and $\overline{n}$, as defined by (2) and (8), are $n_{\max} = 13.4$, and $\overline{n} = 2.68$. The maximum total fertility

[3]The relevant number of children in the Barro-Becker framework is the total fertility rate. This is because the utility of a representative woman depends on her per-capita consumption but also on her total number of children, not children per parent. In other words, altruism implies that the welfare of a child is a non-rival good for parents. For example, if both parents are perfectly altruistic toward their only child then a one util increase in the welfare of the child increases the welfare of each parent in one util too.

[4]All results are identical if n is reinterpreted in our model as the total fertility rate divided by 2 and α is set to 0.8.

rate in the sample is 8.2 which is below $n_{\max}$. However, the typical fertility rate in many countries is larger than $\overline{n}$. In those cases, and for the benchmark calibration, the value of children in terms of longevity increases with the number of children.

2.4. Results

We now report the estimates of various measures of quantity of life as well as consumption equivalent measures of welfare across time and space. We find a significant drop in the effective quantity of life during the 1970-2005 period driven by large reductions in fertility rates. Taking into account the evolution of the effective quantity of life, various hallmark results of economic growth are overturned. For example, many "growth" miracles are not "welfare miracles."

2.4.1. Welfare Across Time

Evolution of The Effective Quantity of Life. Table 1 reports descriptive statistics for various quantity of life measures for a sample of 142 countries and the years 1970 and 2005. The following discussion focuses mainly on the population-weighted average column. Table 1 documents two conflicting trends in quantity of life variables. On the one hand, life expectancy increased on average by around 12 years during the period, from 56.6 years in 1970 to 68.5 in 2005; on the other hand, total fertility rate fell in 2.6 children, from 5.3 to 2.7, on average. Proportionally, the change in fertility was larger than the change in longevity: life expectancy grew by 22.1% while fertility dropped by 48.7%, on average. Given the conflicting trends in T and n, it is unclear what happened to the effective quantity of life.

Consider next the evolution of effective life span, $Q(T)$, effective dynasty size, $Q(n)$, and effective quantity of life, $Q(n, T)$, as described by equations (4), (6) and (5). While life expectancy at birth was 56.6 years on average in 1970, effective life span was only 22.8 years according to the model. The difference is explained by the relative high rate of time discounting assumed by the benchmark. Time discounting also explains why effective life span increased, on average between 1970 to $2005,$ by only 1 year even though life expectancy increased by almost 12 years during the same period.

Regarding effective dynasty size, it was 2.3 in 1970 but only 1.6 in 2005, a net reduction of 0.7 family members. Proportionally, effective life span grew by only 4.6% while effective dynasty size fell by almost 30%. As a result, effective quantity of life, $Q(n,T) = Q(n)Q(T)$, fell by almost 27% during the period, a net loss of 14.4 years of effective life! This is a remarkable and novel result that goes against the well-established notion that the quantity of life relevant to individuals has been increasing in recent times and therefore that welfare has unequivocally increased on average. Instead, the benchmark model suggests the existence of a significant quantity-quality trade-off: part of the observed improvements in the quality of life came at the expense of the quantity of life. The net welfare gain or loss is, in principle, unclear. Finally, Table 1 shows that the value of one more child in terms of life span, $\partial T/\partial n$, was 36 years in 1970 and 53.8 years in 2005. This higher value is partly explained by the fact that children have became more scarce while life span has became more abundant over time.

Table 2 reports detailed results for the 34 most populated countries. Descriptive statistics for this smaller sample are similar to those for the full sample but individual cases differ significantly from the average. Consider first the case of China. During the 1970-2005 period life expectancy increased in 10.6 years, from 62 to 72.6 years. However, according to the benchmark, the effective quantity of life actually dropped by 20.3 years, from 53.2 to 32.9 effective years of life, a 38.1% reduction. This is explained by the significant fall in the total fertility rate, from 5.5 in 1970 to 1.8 in 2005, which implies a 40% reduction in effective dynasty size, from around 2.3 effective members to 1.4 members.

The most extreme case reported in Table 2 is that of Algeria. Measured by life expectancy, the quantity of life increased by almost 19 years during the period, a 35% increase. At the same time, fertility dropped by 5 children, a 67% fall. As a result, the effective quantity of life fell by 48%. Kenya shows a similar net result but for a different reason. Life expectancy there remained mostly unchanged while fertility dropped by 3.1 children, or 38%.

The net welfare consequences of the opposite trends in the quality and the quantity of life are in principle unclear: welfare may have fallen if the quantity effect dominates the quality effect. More generally, the negative trend in the effective quantity of life means that consumption growth overstates welfare growth. We now describe the predictions of the benchmark model regarding the evolution of welfare.

Evolution of Welfare. Table 3 reports descriptive statistics for quality and quantity of life variables as well as implied annual growth rates of various welfare measures in consumption equivalent units, as described by (14). As is well-known, the quality of life significantly increased during the period. Average consumption per-capita increased from $\$2,742$ in 1970 to $\$6,023$ in 2005, for an average annual growth rate of 2.6% per year during the period. On the other hand, according to the model, the effective quantity of life fell from 51.4 years in 1970 to 37 in 2005, which implies an annual growth rate of -2.4% in consumption equivalent units. These figures means that the increase in the quality of life was almost completely offset by the fall in the quantity of life. According to the benchmark, the net average annual growth rate of welfare for the entire sample, in consumption equivalent units, was only 0.2%!

The results summarized in Table 3 are surprising, and perhaps too strong as the robustness checks below suggest, but they are based on parameter values that are deemed plausible. These results illustrate the major significance of fertility for welfare calculations. While recent exercises emphasize gains in the quantity of life due to gains in life expectancy, they ignore the losses due to lower fertility. The reason why the model predicts that welfare mostly stagnated during the period is the large drop in fertility rates. While the effect of longer life expectancy increased welfare at annual rate of 0.3%, the effect of lower fertility reduced welfare at annual rate of 2.8% during the period. The results are even more striking for the median country: welfare decreased at an annual rate of 0.4% for the median country.

Table 4 shows detailed results for the 34 most populated countries. The overall results for this smaller sample are similar to the ones obtained for the set of 142 countries. Individual cases, however, are particularly telling. Consider the case of China for example. Consumption per capita grew from $\$368$ in 1970 to $\$2,1127$ in 2005, which implies an annual growth rate of $5.1\%,$ the highest in the reduced sample and the third highest in the full sample. The Chinesse Miracle was also accompanied by a drastic reduction in total fertility rates, of 3.8 children, largely attributed to the One Child policy. As a result, the effective quantity of life dropped from 53.2 years to 32.9 years in spite of the gains in life expectancy. The implied net annual growth rate of welfare is 1.4% per year, which is significantly less impressive than the growth rate of consumption and below the implied growth rate of welfare in the United States, of 1.8% per year. The Chinesse Miracle disappears, according to the benchmark, once the economic value of the large drop in fertility is taken into account. Similar results are also obtained for other Asian miracles such as South Korea, Indonesia, Malaysia and Thailand. For those countries, the annual growth rates of consumption were 4.9%, 4.6%, $4,0\%$, and $3.8\%,$ all above the US consumption growth rate, but the implied growth rates of welfare were 1.7%, 2.1%, 1.3%, and 0.1%, which are all below US welfare growth, with the exception of Indonesia.

In conclusion, the benchmark model illustrates that increasing consumption growth through fertility reduction is far from a free lunch and that fertility matter when considering the well-being of individuals in a nation.

2.4.2. Welfare Across Space

This section reports measures of quantity of life and welfare, in consumption equivalent units, for the sample of 142 countries and the year 2005. The key formula is (13) which defines the welfare ratio relative to the U.S., $\lambda_i,$ in the term of a quality and quantity ratios: $\lambda_i = \lambda_i(c)\lambda_i(Q)$. The evidence shows that richer countries are characterized by more longevity and less fertility. Therefore, it is in principle unclear whether the effective quantity of life is higher or lower in richer countries. However, the results of the previous section suggest that differences in the effective quantity of life across countries will mostly reflect differences in fertility. We confirm this intuition: for the benchmark calibration individuals in poorer countries typically have a higher effective quantity of life than individuals in richer countries. An implication of this finding is that welfare differences, which collect both differences in the quantity and quality of life, are typically smaller than differences in the quality of life as measured by consumption per capita. Jones and Klenow (2011) reach the opposite conclusion but their model abstracts from fertility differences.

Table 5 summarizes the overall results for the sample of 142 countries and the benchmark calibration. Compared to the U.S., the average country, weighted by population, has 0.6 more children, 9.2 fewer years of longevity and consumes only $1/5$ of U.S. consumption. The implied effective quantity of life is, on average, only 2.4 years higher than in the U.S., a 7% difference. As a result, according to the model, welfare relative to the U.S. is on average 27% higher than what is suggested by consumption per capita ($\lambda(Q) = 1.27$), which is a relative small difference compared with the large differences in the quality of life. λ and $\lambda(c)$ turn out to be very similar on average.

Table 6 shows detailed results for the 45 most populated countries. Consider the column labeled $\lambda(Q)$ which is the welfare ratio explained only by differences in effective quantity of life, or alternatively, the factor by which the consumption ratio needs to be multiplied to correctly reflect welfare differences. Upward adjustments of more than 2.5 times consumption per capita are needed for countries that are particularly poor and have high fertility rates such as Afghanistan, Uganda, Congo, Tanzania and Nigeria. Downward adjustments of more than 20% are needed for countries with low fertility rates such as South Korea, Poland, Romania, Japan, Germany and Spain. Finally, due to its low relative fertility rate, China's relative welfare is 12% below the relative consumption while India's welfare is 23% higher due to its large relative fertility.

In conclusion, we find that the implied adjustments needed for cross country comparisons are not as large as the ones needed for cross time comparisons because demographic differences in 2005 are not as large as the demographic changes that took place during the 1970-2005 period. The implied adjustments, however, are significant for many countries.

3. Robustness

The benchmark model delivers some surprising results. Those results are of major interest because they come naturally from an off-the-shelf Barro-Becker model and a state of the art calibration. However, the benchmark model has also some problematic predictions. According to the model, fertility changes have first order effects on the effective quantity of life and on welfare but life span changes have only second order effects. The last result conflicts with recent studies by Becker *et al.* (2005), Jones and Klenow (2011) and Cordoba and Ripoll (2012) who find significant effects of longevity changes on welfare. Furthermore, the implied rates of substitution between fertility and longevity seem too large. For example, Table 1 reports that in 2005 a typical dynasty in the world is willing to exchange, at the margin, 53.3 years of life for one child. This is a rather large rate of substitution given that average life span was 68.5 years in 2005. Similarly, the significant technological progress during the 1970-2005 period suggests that welfare in the world should have significantly improved during that period but the results in Table 3 suggests instead only marginal improvement in welfare due to the large drop in the effective quantity of life.

Some of the issues arise from the identification procedure. The key parameters of the model are identified by matching macroeconomic targets rather than targets about the value of life. This is in contrast with the literature on longevity and welfare mentioned above. That literature identifies key parameters by targeting empirical evidence on the value of life.

This section reports the results of various robustness checks. It derives model predictions for the value of life and the value of children, reviews evidence on the value of life and the cost of raising children, assesses the ability of the benchmark model to match that evidence, provides an alternative calibration that specifically targets the value of life, and reports the results under the alternative calibration. We also check the robustness of the results to alternative definitions of fertility and longevity: individuals are assumed to be born at age 5, longevity is defined as life expectancy at age 5, and the number of children is defined to be the net fertility rate.

3.1. Value of Life

Value of Statistical Life in the model. In the model, the enjoyment of being alive comes only from the utility flow of consumption. As such, V is the value of being alive. The implicit value of not being alive, meaning dead or unborn, is zero.[5] V, however, is measured in "utils.". The corresponding value of a life in terms of goods, known in the literature as the Value of Statistical Life (VSL), can be defined as:

$$VSL = \frac{V}{u'(c)} = \frac{1}{\gamma} cQ(n, T). \tag{15}$$

The first equality uses the marginal value of consumption to transform the util value of a life into a goods value. The second equality follows from using equation (3) and the functional form $u(c) = c^{\gamma}$. The value of a life in the model is thus proportional to both consumption and the effective quantity of life. Moreover, it depends on the parameter controlling the curvature of the utility function, γ, a property that is used below to identify γ based on empirical evidence about the value of statistical life. The more the curvature of the utility function, or the lower the value of γ, the larger the value of life.

Value of a Child in the model. Similarly, the value to the parent of an additional child is $\partial V/\partial n$ in utils or $\frac{\partial V/\partial n}{u'(c)}$ in units of goods. Let VC be the value to

[5] Cordoba and Ripoll (2011, 2012) discuss some of these issues.

the parent of an additional child at the time the child is born. It is defined as:

$$\begin{aligned} VC &= \beta^{-F}\frac{\partial V/\partial n}{u'(c)} = \alpha\left(1-\varepsilon\right)n^{-\varepsilon}\frac{V'}{u'(c)} \\ &= \alpha\left(1-\varepsilon\right)n^{-\varepsilon}VSL. \end{aligned} \tag{16}$$

This last expression states that VC is the value of statistical life weighted by the marginal degree of altruism toward the last child. For example, if $\varepsilon = 0$, so that altruism is linear in the number of children, then $VC = \alpha VSL.$ The dependence of VC on α is used below to identify this parameter based on evidence about the cost of raising children.

Evidence on the Value of Stastical Life. There is a large literature estimating the value of statistical life. The VSL is often estimated from wage differential across occupations with different mortality risks or from market prices for products that reduce fatal injuries. Estimates of the VSL range between $\$4$ to $\$9$ millions (Viscusi 1993, Viscusi and Aldy 2003). The Environmental Protection Agency uses a value of $\$6.3$ millions in cost-benefit analysis. A similar values is used by Murphy and Topel (2006) when assessing the value of health and longevity. They also provide life-cycle estimates for VSL that range from $\$6.3$ million at birth, reaches $7 million at age 30, declines to $\$5$ million by age 50 and $\$2$ million by age 70. (See their Figure 3).

Evidence on the cost of children. To the extent of our knowledge, estimates of the value of a child are unavailable. However, standard economic arguments suggest that if decisions are nearly optimal then the value of the last child to the parent must be similar to the cost of raising that child. Table 7 summarizes the main calculations that follow regarding the costs of raising a child.

The U.S. Department of Agriculture estimates that the total present value of expenses on a child born in 2009 for a middle-income husband-wife family with two children is $\$226,920$ in 2010 dollars (USDA, 2010, page 23). These expenses include direct parental expenses made on children through age 17 such as housing, food, transportation, health care, clothing, child care, and private expenses in education. Major items excluded are the time costs and forgone earnings by parents, college costs and other costs after age 17. Moreover, the estimate implicitly assumes a zero real interest rate. If an interest rate of 4% is used, as in the benchmark, then the present value of the total cost of raising a child up to age 17 is $\$163,222$.

Adjustments for time costs of child rearing and college costs can be made. Regarding time costs, Folbre (2008, pg. 114) estimates an average amount of parental-care hours per child from birth to age eleven of about 40 hours per week, or around $2,080$ hours per year, for both parents. On the other hand, the Bureau of Labor and Statistics[6] estimates that the median hourly wage for all occupations was $\$20$ in 2010. These figures suggest an annual time cost of raising children, for both parents, of $\$41,600$ up to age 11. Folbre does not provide estimates for time costs after age 11. For the calculations below, we assume time costs between ages 12-17 to be 1/3 of the costs at earlier ages. Under these assumptions, the present value of the time costs of raising a child until age 17 for both parents is $\$451,140$.

Regarding college costs, the College Board (2011) estimates net costs of attending college in different types of institutions. Net costs includes tuition, fees, room and board minus grant aid from all sources, federal education tax credits and other deductions. The estimated annual costs for Full-Time Undergraduates in a Public Four-Year institution is $\$11,380$, $\$6,600$ in a Public Two-Year institution, and $\$23,060$ in a Private Nonprofit Four Year institution for the 2011-12 academic year. Enrollments in those institutions are 44%, 26% and 19% respectively which represents 89% of total enrollment. These figures suggest an average cost of $\$14,902$ per year for a 4 year college, or $\$27,353$ in present value at time of birth.

In summary, the present value at birth of the cost of raising a child for a middle-income family with two children, including college costs and parental-time cost, is in the order of $\$640,000$ for both parents or $\$320,000$ per parent.

[6]http://www.bls.gov/oes/current/oes_nat.htm#00-0000. Last accessed on 10/13/2012.

These calculations assume a 4% annual interest rate. The costs are in the order of $\$370,000$ per parent if an interest of 2% is assumed instead.

3.2. Assessment of the Benchmark

For the assumed parameter values and country specific consumption and fertility rates, equations (15) and (16) can be used to calculate the implied value of statistical life and the value of a child. According to the Bureau of Economic Analysis, U.S. consumption per capita was $\$33,038$ in 2010, while according to the World Bank the total fertility rate is around 2.1. The implied value of statistical life in the benchmark is of around $\$3$ million. This amount is below the $\$4-9$ millions range of existing estimates, and around half the $\$6.3$ million value used by the Environmental Protection Agency, which is also the value used by Morphy and Topel (2006). This relatively low value of life implied by the benchmark explains why longevity changes have smaller effect on welfare than what a related literature finds. As for the value of a child, the model implies a value of around $\$760,000$, an amount that is more than twice the cost of raising a child, which according to our estimates above is close to $\$320,000$. Therefore, the benchmark seems to undervalue life and overvalue children significantly.

3.3. Alternative Calibration

We now consider an alternative calibration that seeks to match evidence on the value of life as follows. First, we pick the curvature of the utility function, γ, in order to match a target for the value of statistical life. In the benchmark model, γ is identified using evidence on the elasticity of intertemporal substitution but, as (15) makes clear, γ also determines VSL. Cordoba and Ripoll (2012) have shown that the parameter γ controls both the elasticity of intertemporal substitutions as well as the coefficient of death aversion. When they disentangle both parameters, using Epstein-Zin type of preferences, they find that the value of statistical life follows a formula similar to (15) but the parameter γ is the coefficient of death aversion, not the intertemporal elasticity of substitution. In the current set up, with a single parameter controlling two aspects of preferences, it is important that the model delivers the correct predictions for the value of life. This motivates our alternative identification procedure of matching the value of statistical life rather than the intertemporal elasticity of substitution. Consistent with existent evidence, we target a VSL of $\$5$ millions in 2010 dollars[7].

Second, we set the interest rate to 2% which is more in line with the evidence about riskless interest rates in the U.S. A lower interest rate has two effects: first, it increases the value of statistical life predicted by the model by increasing $Q(n,T)$; second, it increases the cost of raising a child, which in present value translates to around $\$370,000$.

Finally, we pick α so that the willingness to pay for a child is also $\$370,000$. Other parameters are left unchanged. The resulting parameters are $\gamma = 0.31$ and $\alpha = 0.148$. Comparing with the benchmark values of 0.38 and 0.5, the curvature of the utility function slightly increases and the weight of children in the utility of their parents decreases significantly. The curvature of the utility function is similar to the one used by Becker et al. (2005), and the implied elasticity of intertermporal substitution is still within the range of plausible values documented by Browning et al. (1999, pg. 614).

The corresponding values of $n_{\max}$ and $\overline{n}$, as defined by (2) and (8), are 68.4, and 13.6 respectively, values that are well above the maximum total fertility rate in the sample of 8.2. As a result, the value of children under the alternative calibration decreases with the number of children for all empirical relevant values of n, avoiding thus another shortcoming of the benchmark calibration.

[7]We choose to target \$5 rather than \$6.3 million due to life-cycle considerations. Empirical estimates of the VSL are typically for middle age individuals who are at the peak of their earning potential. Our calculation is for individuals at birth.

3.4. Results for the Alternative Calibration

Welfare across time. Table 8 reports quantity of life measures for the years 1970 and 2005 using the alternative calibration and the full sample. As before, we focus on the weighted average column. According to the alternative model, the average effective quantity of life in the world fell from 46.8 years in 1970 to 45.5 in 2005. This confirms the result of the benchmark but now the fall is much less pronounced: the increase in longevity during the period is, for the most part, able offset the drop in fertility. This is because longevity has more value and children less value under the alternative calibration. The willingness to substitute life span for children, $\partial T/\partial n,$ was 36 years in 1970 in the benchmark but only 5.1 years in the alternative. The main finding of the paper is therefore that, in spite of the large gains in life expectancy, the effective quantity of life in the world has either fell significantly or remained roughly constant during the period. Regardless of the calibration, the fertility decline has a first order effect on the quantity of life that individuals in the model care about.

Table 9 reports detailed results about the quantity of life for the 34 largest countries. Notice that the range of changes in the effective quantity of life is relative narrow: from -6.4 to 4.1 years. Countries in which the effective quantity of life decreased by more than five years are China, Mexico, Thailand, South Africa, and Kenya, countries showing some of the largest fertility drops. Countries in which the effective quantity of life increased by more than three years are Indonesia, Nigeria and Afghanistan, countries with small fertility changes and/or important gains in life expectancy.

Table 10 reports overall results for the evolution of welfare around the world. Gains in life expectancy add 0.9 points to annual welfare growth but fertility losses substrates 1.1 points. Ignoring the effect of fertility, welfare growth would be significantly higher than consumption growth, which is now consistent with the findings of Becker et al (2005), Jones and Klenow (2011) and Cordoba and Ripoll (2012). However, taking fertility changes into account, the rate of consumption growth of 2.6% turns out to approximate the rate of welfare growth, of 2.4%, very closely. In other words, the alternative model suggests that welfare growth since the 1970s has been, on average, mostly driven by growth in the quality of life since the effective quantity of life has remained roughly constant.

Table 11 shows detailed results for the 34 most populated countries. While on average consumption growth describes well welfare growth in the world and in many countries such as Bangladesh, Germany, France, United Kingdom, Argentina and Canada, in other countries welfare growth differs significantly from consumption growth. Countries for which the effective quantity of life fell by more than 5 years (China, Mexico, Thailand, South Africa and Kenya) are also countries in which consumption growth overstates welfare growth by at least 1 percentage points. Countries for which the effective quantity of life increased by more than 3 years (Indonesia, Nigeria, and Afghanistan) are also countries in which consumption growth understates welfare growth by at least 0.5 percentage points. Morocco exemplifies an extreme case in which a significant increase in life expectancy, of almost 19 years, is more than offset by a major decline in fertility, of 4.64 children.

Welfare across countries. Table 12 reports the overall results regarding welfare across countries in 2005. While the average quantity of life in the world was 2.4 years higher than in the U.S. according to the benchmark, it is 1.55 years below in the alternative. This reflects the higher value that the alternative model places on life expectancy relative to fertility. According to the alternative model welfare relative to the U.S. is on average 10% lower than what is suggested by consumption per capita ($\lambda(Q) = 0.90$). Notice that fertility alone would have increased average welfare in 12% ($\lambda(n) = 1.12$). Average λ and $\lambda(c)$ are very similar again due to the fact that the main adjustments are for poorer countries. Table 13 shows more detailed results for the 45 most populated countries. Contrary to the benchmark, there are no major upward reassessments but only significant downward reassessments (see column $\lambda(Q)$). The most significant ones are South Africa, Afghanistan, Mozambique, Nigeria, Congo and Kenya, mostly due to their shorter life span. Looking at column $\lambda(n)$ it is also clear that the high fertility in those same countries prevented a larger drop.

3.5. Further Robustness Checks

We also check the robustness of the results to changes in the parameter ε. This parameter controls the degree of diminishing altruism towards additional children. Birchenall and Soares (2009) reports various calibrated values for this parameter in a related model.[8] They report values of ε between 0.42 to 0.61 which are larger than the value of 0.35 used above. As a robustness check, we set ε to 0.5 and recalibrate γ and α to match a VSL of $\$5$ million and a value of a child of $\$370,000$. The results are similar to the ones found for the alternative model, both for the overall sample as well as for individual countries. For example, between 1970 and 2005, the effective quantity of life fell by 1.2 year instead of 1.3 years while the annual growth rate of welfare in the world, in consumption equivalent units, is the same as in the alternative, 2.4%.

As a final robustness check, we let the initial age to be 5. The purpose of this exercise is to assess whether the results are mostly due to differences in infant mortality. For this exercise, V is lifetime welfare at age 5, and n and T are set equal to the number of surviving children at age 5 and life expectancy at age 5 respectively. We use the same parameters of the alternative calibration which implies a VSL of $\$4.9$ million and a value of a child of $\$361,000$ for the U.S. Due to data limitations regarding infant mortality, the sample for this exercise includes only 120 countries. The overall results are reported in Table 14. The implied annual growth rate of effective quantity of life is -0.4% for the entire sample. As a result, annual consumption growth overstates by 0.4 percentage points the annual growth rate of welfare. This reinforces the main message of

[8]Their parameter ϕ equals $1-\varepsilon$ in our model. Their model is similar but not directly comparable to ours. They add various features to the standard Barro-Becker model and follow a different calibration strategy. For example, they report (pg. 291) that the monetary value of a child in their model is of around $\$100,000$ dollars, which is significantly lower than our target of $\$370,000$. Their model also matches values of statistical life that are on lower side of the estimates reported by Viscusi and Aldy (2003).

the paper.

4. Conclusion

My parents have four children. My wife and I have two. While we enjoy a significantly higher quality of life than my parents did at the same age, as measured by the amount of material consumption in our home, it is not clear that I am actually better off than my parents were at the same age. Our kids are our main treasure for my wife and I, and my parents had twice as many. We decided not to have more children because of their high costs. We decided to trade quantity for quality. While our generation obtains most of its lifetime satisfaction from material consumption, a generation or two ago obtained a larger part of their enjoyment from their children, and more generally, from the enjoyment of their family and friends. Taking into account the differences in the number of children, am I doing better than my parents did? More generally, is our generation better off than a generation ago? Analogous questions arise when comparing individuals of the same generation. My quality of life is significantly higher than the one of a typical individual in India of the same age but, at the same time, my family has one less child than a typical indian family. Am I really better off?

This paper uses calibrated versions of the Barro-Becker model to answer questions like the ones above. Although children clearly have substantial economic value and fertility rates vary substantially across time and space, existent studies have ignored the impact of these differences on individual well-being. This paper finds that fertility changes have first order effects on welfare. For the most standard calibration, the one proposed by Manuelli and Seshadri (2009), the results are striking. The model suggests that individual's welfare around the world mostly stagnated during the period 1970-2005 in spite of the substantial increase in the quality of life and life spans. The reason for the stagnation is the substantial drop in fertility rates which gave rise to a significant reduction in the effective quantity of life at the individual level. Results are less striking but still surprising for other calibrations. For our preferred calibration, one that targets the value of life and the cost of raising children, we find that in spite of the substantial gains in life expectancy the effective quantity of life mostly stagnated during the period. The reason, again, is the significant drop in fertility rates around the globe. Given that the effective quantity of life stagnated, welfare growth seems to be well approximated by consumption growth on average, although not for many individual countries such as China.

A literature on the demographic dividend (see Ashraf, et al 2011, Bloom et al. 2009 among others) emphasizes the economic gains of fertility reductions. The One Child policy in China is perhaps the most successful example of the potential gains of demographic policies: the policy is part of the mix responsible for the Chinese miracle of the last three decades. What is missing from this literature are the costs associated to demographic policies, as if those policies are really a free lunch. This paper finds that, on the contrary, demographic polices are enormously costly.

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Figure 1. Total Fertility Rate Versus GDP Per-Capita, 2005

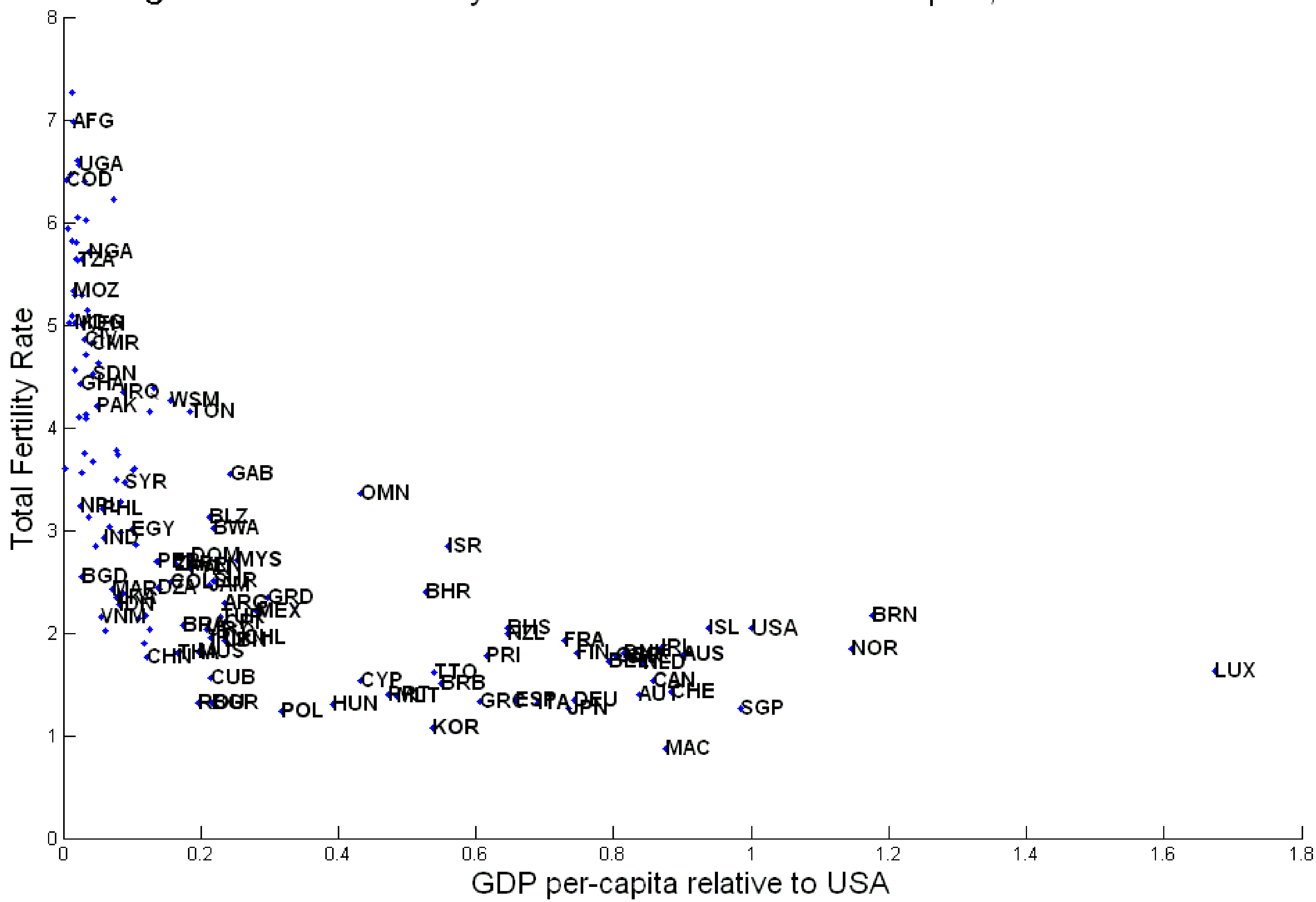

Figure 2. GDP Per-capita 2005 Vs. Change in Total Fertility Rate 1970-2005

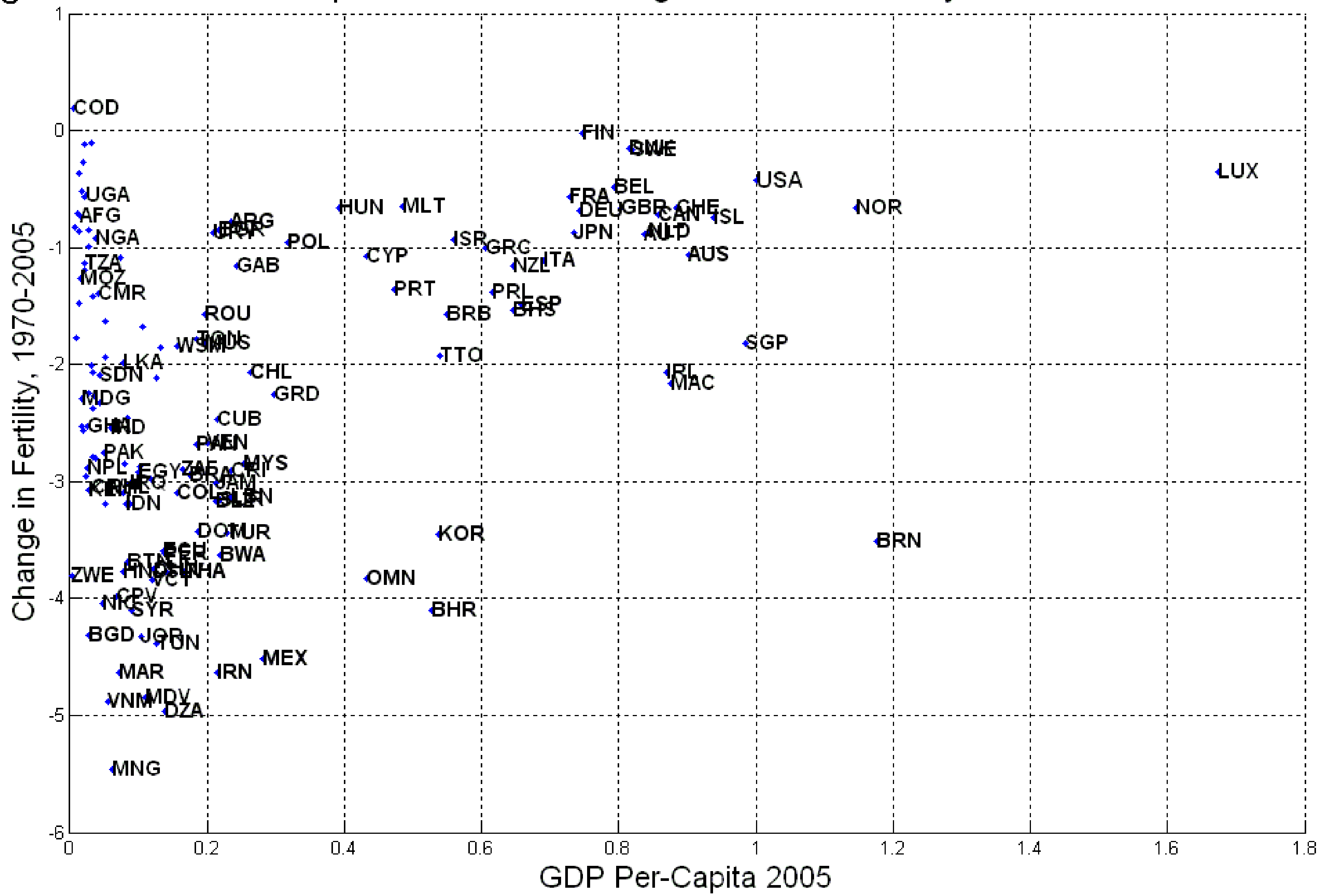

Table 1 ---- Quantity of Life in the World, Benchmark Calibration, 1970-2005

	min	max	range	Average unweighted	Average pop-weighted	Median Unweighted	Standard Deviation unweighted	Standard Deviation pop-weigthed
1970								
n	1.8	8.2	6.4	5.3	5.3	6.0	1.9	1.5
T	35.0	74.6	39.6	56.8	56.6	55.5	11.2	9.4
Q(n)	1.4	3.6	2.3	2.3	2.3	2.4	0.6	0.5
Q(T)	19.5	24.3	4.8	22.7	22.8	22.8	1.2	1.0
Q(n,T)	33.0	79.4	46.4	52.5	51.4	53.8	11.7	9.1
∂T/∂n	13.0	65.1	52.1	37.5	36.0	36.1	14.0	12.4
2005								
n	0.9	7.3	6.4	3.2	2.7	2.7	1.6	1.3
T	41.5	81.9	40.5	67.0	68.5	71.0	11.4	8.7
Q(n)	1.2	3.0	1.8	1.7	1.6	1.5	0.4	0.3
Q(T)	20.8	24.6	3.7	23.6	23.8	24.1	1.0	0.7
Q(n,T)	29.5	67.0	37.5	39.7	37.0	37.1	7.9	6.2
∂T/∂n	14.8	93.5	78.7	53.3	53.8	55.4	21.2	17.2
Increment, 1970-2005								
n	(5.5)	0.2	5.7	(2.2)	(2.6)	(2.1)	1.3	1.3
T	(13.4)	25.7	39.1	10.3	11.9	9.8	6.2	4.9
Q(n)	(1.7)	0.1	1.8	(0.6)	(0.7)	(0.6)	0.4	0.4
Q(T)	(1.9)	3.0	4.9	0.9	1.0	0.8	0.7	0.6
Q(n,T)	(37.3)	3.7	41.0	(12.8)	(14.4)	(12.3)	9.6	8.1
Growth Rates (%), 1970-2005								
n	(76.2)	3.1	79.3	(40.0)	(48.7)	(41.1)	18.5	18.4
T	(24.4)	59.8	84.2	19.4	22.1	17.1	13.4	11.2
Q(n)	(55.1)	3.2	58.3	(25.4)	(29.7)	(25.3)	13.8	12.9
Q(T)	(8.5)	14.5	23.0	4.2	4.6	3.4	3.5	2.8
Q(n,T)	(52.7)	6.7	59.4	(22.4)	(26.6)	(22.5)	14.1	12.9

Notes : total fertility rate (n) and life expectancy at birth (T) are from the World Development Indicators of the World Bank; Q(T), Q(n) and Q(n,T) are effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. ∂T/∂n is the value of a child in terms of years of life. Sample includes 142 countries.

Table 2 ---- Quantity of Life in the Most Populated Countries, Benchmark Calibration, 1970-2005

	POP 2005	1970						2005						Increments					Growth Rates (%)				
Country Name	mill	n	T	Q(n)	Q(T)	Q(n,T)	∂T/∂n	n	T	Q(n)	Q(T)	Q(n,T)	∂T/∂n	n	T	Q(n)	Q(T)	Q(n,T)	n	T	Q(n)	Q(T)	Q(n,T)
China	1,298	5.5	62.0	2.3	23.4	53.2	42.7	1.8	72.6	1.4	24.2	32.9	60.2	(3.8)	10.6	(0.9)	0.7	(20.3)	(68.1)	17.1	(39.9)	3.0	(38.1)
India	1,091	5.5	48.8	2.3	22.0	49.7	23.6	2.9	62.8	1.6	23.5	37.4	38.7	(2.5)	13.9	(0.7)	1.5	(12.3)	(46.4)	28.6	(29.5)	6.7	(24.7)
United States	296	2.5	70.8	1.5	24.1	36.1	54.5	2.1	77.7	1.4	24.4	34.6	73.7	(0.4)	6.9	(0.1)	0.3	(1.5)	(17.2)	9.8	(5.4)	1.5	(4.1)
Indonesia	229	5.5	47.6	2.3	21.9	49.3	22.3	2.3	69.7	1.5	24.0	35.0	52.1	(3.2)	22.1	(0.8)	2.1	(14.3)	(58.3)	46.4	(35.3)	9.8	(28.9)
Brazil	189	5.0	58.6	2.1	23.1	48.9	35.4	2.1	71.6	1.4	24.1	34.3	57.0	(2.9)	13.1	(0.7)	1.0	(14.6)	(58.7)	22.3	(32.7)	4.1	(29.9)
Pakistan	169	7.0	54.3	2.9	22.7	65.0	35.4	4.2	65.6	1.9	23.7	44.7	45.5	(2.7)	11.3	(1.0)	1.0	(20.3)	(39.5)	20.7	(34.2)	4.5	(31.3)
Bangladesh	144	6.9	44.1	2.8	21.3	60.1	21.8	2.6	64.6	1.5	23.7	35.8	41.8	(4.3)	20.5	(1.3)	2.3	(24.3)	(62.8)	46.5	(46.3)	11.0	(40.4)
Nigeria	137	6.6	40.4	2.7	20.6	55.8	17.7	5.7	47.2	2.3	21.8	50.9	22.4	(0.9)	6.9	(0.4)	1.2	(4.8)	(13.8)	17.1	(13.6)	5.7	(8.7)
Japan	128	2.1	72.0	1.4	24.1	34.6	57.6	1.3	81.9	1.3	24.6	31.3	93.5	(0.9)	10.0	(0.2)	0.5	(3.3)	(41.0)	13.9	(11.2)	1.9	(9.5)
Mexico	106	6.7	61.4	2.7	23.4	64.3	47.0	2.2	74.4	1.4	24.3	35.1	63.9	(4.5)	13.1	(1.3)	0.9	(29.2)	(67.2)	21.3	(47.4)	3.7	(45.5)
Philippines	90	6.3	57.2	2.5	23.0	58.7	37.2	3.2	71.0	1.7	24.1	39.7	55.4	(3.0)	13.8	(0.9)	1.1	(18.9)	(48.7)	24.2	(35.3)	4.6	(32.3)
Vietnam	84	7.0	48.9	2.9	22.0	64.0	27.9	2.2	73.7	1.4	24.2	34.8	62.0	(4.9)	24.8	(1.5)	2.2	(29.2)	(69.4)	50.8	(50.5)	9.9	(45.6)
Germany	82	2.0	70.5	1.4	24.0	34.0	54.3	1.3	79.3	1.3	24.5	31.5	83.0	(0.7)	8.8	(0.1)	0.4	(2.5)	(34.0)	12.6	(8.9)	1.8	(7.2)
Turkey	73	5.6	55.7	2.3	22.9	52.5	32.6	2.2	71.4	1.4	24.1	34.6	56.2	(3.4)	15.7	(0.9)	1.2	(17.9)	(61.4)	28.2	(37.5)	5.4	(34.1)
Egypt	73	5.9	50.4	2.4	22.2	53.8	26.5	3.0	69.5	1.6	24.0	38.5	51.7	(2.9)	19.1	(0.8)	1.7	(15.2)	(49.2)	37.9	(33.5)	7.8	(28.3)
Iran	72	6.6	53.9	2.7	22.7	60.8	33.2	1.9	70.7	1.4	24.1	33.6	55.0	(4.6)	16.7	(1.3)	1.4	(27.2)	(70.4)	31.1	(47.9)	6.1	(44.7)
Thailand	64	5.6	59.4	2.3	23.2	53.2	38.4	1.8	68.4	1.4	23.9	32.8	50.4	(3.8)	9.0	(0.9)	0.7	(20.5)	(67.7)	15.2	(40.2)	3.0	(38.4)
France	63	2.5	72.0	1.5	24.1	36.2	57.4	1.9	80.2	1.4	24.5	34.1	82.2	(0.6)	8.2	(0.1)	0.4	(2.1)	(22.7)	11.4	(7.2)	1.6	(5.7)
Congo	61	6.2	43.8	2.5	21.2	53.7	20.0	6.4	47.6	2.6	21.9	57.0	24.4	0.2	3.8	0.1	0.6	3.3	3.1	8.8	3.2	2.9	6.1
United Kingdom	60	2.4	72.0	1.5	24.1	36.0	57.3	1.8	79.1	1.4	24.5	33.4	79.0	(0.7)	7.1	(0.1)	0.3	(2.5)	(27.0)	9.9	(8.3)	1.4	(7.0)
Italy	59	2.4	71.6	1.5	24.1	35.9	56.3	1.3	80.8	1.3	24.5	31.5	88.3	(1.1)	9.2	(0.2)	0.4	(4.4)	(45.6)	12.8	(13.7)	1.8	(12.2)
Korea, Rep.	48	4.5	61.2	2.0	23.4	46.1	38.5	1.1	78.4	1.2	24.4	30.3	83.2	(3.5)	17.2	(0.7)	1.1	(15.8)	(76.2)	28.1	(37.0)	4.5	(34.2)
South Africa	47	5.6	52.8	2.3	22.5	51.7	28.7	2.7	51.8	1.5	22.4	34.5	23.7	(2.9)	(1.1)	(0.8)	(0.1)	(17.2)	(52.0)	(2.0)	(32.9)	(0.6)	(33.3)
Spain	44	2.8	72.0	1.6	24.1	37.9	57.4	1.4	80.2	1.3	24.5	31.6	86.2	(1.5)	8.2	(0.3)	0.4	(6.3)	(52.4)	11.4	(17.9)	1.6	(16.6)
Colombia	41	5.6	60.9	2.3	23.4	53.7	41.0	2.5	72.3	1.5	24.1	36.3	58.0	(3.1)	11.4	(0.8)	0.8	(17.4)	(55.4)	18.7	(34.7)	3.4	(32.5)
Argentina	39	3.1	66.6	1.6	23.8	38.5	45.7	2.3	74.8	1.5	24.3	35.5	64.6	(0.8)	8.2	(0.2)	0.5	(3.1)	(25.5)	12.3	(9.8)	2.0	(7.9)
Poland	39	2.2	69.9	1.4	24.0	34.7	52.7	1.2	74.9	1.3	24.3	30.8	70.0	(1.0)	5.1	(0.2)	0.3	(3.9)	(43.6)	7.3	(12.2)	1.1	(11.2)
Sudan	38	6.6	46.4	2.7	21.7	58.4	23.6	4.5	57.3	2.0	23.0	45.3	32.3	(2.1)	10.9	(0.7)	1.4	(13.2)	(31.6)	23.5	(27.1)	6.3	(22.5)
Tanzania	38	6.8	46.7	2.8	21.7	60.2	24.4	5.6	53.6	2.3	22.6	52.3	29.8	(1.1)	6.9	(0.5)	0.9	(7.9)	(16.8)	14.9	(16.6)	4.2	(13.1)
Kenya	35	8.1	52.2	3.5	22.5	79.4	37.7	5.0	52.4	2.1	22.5	47.4	26.8	(3.1)	0.2	(1.4)	0.0	(32.1)	(38.1)	0.4	(40.4)	0.1	(40.4)
Algeria	33	7.4	52.9	3.1	22.6	69.9	35.2	2.4	71.6	1.5	24.1	35.9	56.5	(5.0)	18.7	(1.6)	1.6	(34.0)	(67.1)	35.4	(51.9)	6.9	(48.6)
Canada	32	2.3	72.7	1.5	24.2	35.2	59.3	1.5	80.3	1.3	24.5	32.4	84.7	(0.7)	7.6	(0.1)	0.4	(2.7)	(31.8)	10.4	(9.1)	1.4	(7.8)
Afghanistan	30	7.7	35.0	3.3	19.5	63.8	15.5	7.0	42.9	2.9	21.1	60.6	20.9	(0.7)	7.9	(0.4)	1.6	(3.3)	(9.4)	22.4	(12.5)	8.4	(5.1)
Morocco	30	7.1	51.6	2.9	22.4	65.3	31.7	2.4	70.4	1.5	24.0	35.8	53.7	(4.6)	18.8	(1.4)	1.6	(29.5)	(65.7)	36.5	(49.0)	7.3	(45.2)
min	30	2.0	35.0	1.4	19.5	34.0	15.5	1.1	42.9	1.2	21.1	30.3	20.9	(5.0)	(1.1)	(1.6)	(0.1)	(34.0)	(76.2)	(2.0)	(51.9)	(0.6)	(48.6)
max	1,298	8.1	72.7	3.5	24.2	79.4	59.3	7.0	81.9	2.9	24.6	60.6	93.5	0.2	24.8	0.1	2.3	3.3	3.1	50.8	3.2	11.0	6.1
range	1,268	6.1	37.7	2.1	4.7	45.5	43.8	5.9	39.0	1.6	3.5	30.2	72.6	5.2	25.9	1.7	2.5	37.2	79.3	52.8	55.1	11.6	54.7
Average, unw.	149	5.2	57.5	2.3	22.8	51.5	38.0	2.8	68.8	1.6	23.8	37.7	56.7	(2.4)	11.3	(0.7)	0.9	(13.8)	(45.0)	20.8	(27.2)	4.3	(24.4)
Average, weig.	636	5.2	56.9	2.2	22.8	50.9	36.1	2.5	69.1	1.5	23.9	36.2	54.5	(2.7)	12.2	(0.7)	1.0	(14.7)	(50.7)	22.5	(30.6)	4.7	(27.5)
Median	64	5.6	56.5	2.3	22.9	53.2	36.3	2.2	71.5	1.5	24.1	34.9	56.4	(2.8)	10.3	(0.7)	0.9	(14.4)	(47.5)	17.9	(32.8)	3.9	(28.6)
Std Dev	273	1.9	10.7	0.6	1.2	12.1	13.5	1.6	10.8	0.4	0.9	7.7	21.1	1.5	6.0	0.5	0.6	10.5	20.4	12.8	15.8	3.0	15.5
Std Dev, weig.	544	1.4	9.0	0.4	0.9	8.4	12.0	1.1	7.9	0.3	0.6	5.2	16.4	1.3	4.5	0.4	0.6	7.9	17.8	10.7	12.7	2.6	12.6

Notes: total fertility rate (n) and life expectancy at birth (T) are from the World Development Indicators of the World Bank; Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. ∂T/∂n is the value of a child in terms of years of life.

Table 3 ---- Evolution of Welfare Around the World, Benchmark Calibration, 1970-2005

	min	max	range	Average		Median	Standard Deviation	
				unweighted	pop-weighted	Unweighted	unweighted	pop-weigthed
1970								
c	169	15,972	15,802	3,555	2,742	1,645	3,858	4,087
Q(n)	1.4	3.6	2.3	2.3	2.3	2.4	0.6	0.5
Q(T)	19.5	24.3	4.8	22.7	22.8	22.8	1.2	1.0
Q(n,T)	33.0	79.4	46.4	52.5	51.4	53.8	11.7	9.1
2005								
c	159	32,231	32,072	7,018	6,023	3,660	7,896	8,526
Q(n)	1.2	3.0	1.8	1.7	1.6	1.5	0.4	0.3
Q(T)	20.8	24.6	3.7	23.6	23.8	24.1	1.0	0.7
Q(n,T)	29.5	67.0	37.5	39.7	37.0	37.1	7.9	6.2
Annual Growth Rates of Welfare Measures in Consumption Equivalent Units (%)								
g^c	(4.3)	5.6	9.9	1.5	2.6	1.6	1.7	1.8
g^n	(6.0)	0.2	6.3	(2.3)	(2.8)	(2.2)	1.4	1.3
g^T	(0.7)	1.0	1.7	0.3	0.3	0.2	0.3	0.2
$g^Q = g^n+g^T$	(5.6)	0.5	6.1	(2.0)	(2.4)	(1.9)	1.4	1.3
$g = g^c+g^Q$	(5.4)	3.2	8.6	(0.5)	0.2	(0.4)	2.0	1.6

Notes: c is consumption per-capita obtained from the Penn World Tables 7.1. Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. g^c, g^n, g^T, g^Q, and g, are the annual growth rates of consumption, fertily, life span, quantity of life and welfare, all in consumption equivalent units, according to author's calculations.

Table 4 ---- Evolution of Welfare, Most Populated Countries, Benchmark Calibration, 1970-2005

	POP 2005	1970				2005				Annual Growth Rates of Welfare (%)				
Country Name	mill	c	Q(n)	Q(T)	Q(n,T)	c	Q(n)	Q(T)	Q(n,T)	g^c	g^n	g^T	g^Q	g
China	1,298	368	2.3	23.4	53.2	2,127	1.4	24.2	32.9	5.0	(3.8)	0.22	(3.6)	1.4
India	1,091	652	2.3	22.0	49.7	1,569	1.6	23.5	37.4	2.5	(2.6)	0.5	(2.1)	0.4
United States	296	15,209	1.5	24.1	36.1	32,231	1.4	24.4	34.6	2.1	(0.4)	0.1	(0.3)	1.8
Indonesia	229	438	2.3	21.9	49.3	2,219	1.5	24.0	35.0	4.6	(3.3)	0.7	(2.6)	2.1
Brazil	189	3,160	2.1	23.1	48.9	5,962	1.4	24.1	34.3	1.8	(3.0)	0.3	(2.7)	(0.9)
Pakistan	169	928	2.9	22.7	65.0	1,659	1.9	23.7	44.7	1.7	(3.1)	0.3	(2.8)	(1.2)
Bangladesh	144	814	2.8	21.3	60.1	882	1.5	23.7	35.8	0.2	(4.7)	0.8	(3.9)	(3.7)
Nigeria	137	1,239	2.7	20.6	55.8	1,172	2.3	21.8	50.9	(0.2)	(1.1)	0.4	(0.7)	(0.8)
Japan	128	8,601	1.4	24.1	34.6	20,421	1.3	24.6	31.3	2.5	(0.9)	0.1	(0.7)	1.7
Mexico	106	4,990	2.7	23.4	64.3	9,152	1.4	24.3	35.1	1.7	(4.8)	0.3	(4.6)	(2.8)
Philippines	90	1,278	2.5	23.0	58.7	2,047	1.7	24.1	39.7	1.3	(3.3)	0.3	(2.9)	(1.6)
Vietnam	84	494	2.9	22.0	64.0	1,369	1.4	24.2	34.8	2.9	(5.3)	0.7	(4.6)	(1.7)
Germany	82	10,204	1.4	24.0	34.0	20,643	1.3	24.5	31.5	2.0	(0.7)	0.1	(0.6)	1.4
Turkey	73	3,698	2.3	22.9	52.5	7,618	1.4	24.1	34.6	2.1	(3.5)	0.4	(3.1)	(1.1)
Egypt	73	1,312	2.4	22.2	53.8	3,265	1.6	24.0	38.5	2.6	(3.1)	0.6	(2.5)	0.1
Iran	72	2,192	2.7	22.7	60.8	4,790	1.4	24.1	33.6	2.2	(4.9)	0.4	(4.5)	(2.2)
Thailand	64	1,201	2.3	23.2	53.2	4,463	1.4	23.9	32.8	3.8	(3.9)	0.2	(3.6)	0.1
France	63	10,573	1.5	24.1	36.2	21,590	1.4	24.5	34.1	2.0	(0.6)	0.1	(0.4)	1.6
Congo	61	692	2.5	21.2	53.7	173	2.6	21.9	57.0	(4.0)	0.2	0.2	0.4	(3.5)
United Kingdom	60	11,467	1.5	24.1	36.0	26,644	1.4	24.5	33.4	2.4	(0.7)	0.1	(0.5)	1.9
Italy	59	9,376	1.5	24.1	35.9	19,536	1.3	24.5	31.5	2.1	(1.1)	0.1	(1.0)	1.1
Korea, Rep.	48	2,227	2.0	23.4	46.1	12,222	1.2	24.4	30.3	4.9	(3.5)	0.3	(3.1)	1.7
South Africa	47	3,276	2.3	22.5	51.7	5,023	1.5	22.4	34.5	1.2	(3.0)	(0.0)	(3.0)	(1.8)
Spain	44	8,089	1.6	24.1	37.9	19,027	1.3	24.5	31.6	2.4	(1.5)	0.1	(1.4)	1.1
Colombia	41	2,302	2.3	23.4	53.7	4,919	1.5	24.1	36.3	2.2	(3.2)	0.2	(3.0)	(0.8)
Argentina	39	5,064	1.6	23.8	38.5	6,893	1.5	24.3	35.5	0.9	(0.8)	0.1	(0.6)	0.3
Poland	39	4,441	1.4	24.0	34.7	10,016	1.3	24.3	30.8	2.3	(1.0)	0.1	(0.9)	1.4
Sudan	38	1,100	2.7	21.7	58.4	1,540	2.0	23.0	45.3	1.0	(2.4)	0.5	(1.9)	(1.0)
Tanzania	38	469	2.8	21.7	60.2	618	2.3	22.6	52.3	0.8	(1.4)	0.3	(1.1)	(0.3)
Kenya	35	859	3.5	22.5	79.4	1,035	2.1	22.5	47.4	0.5	(3.9)	0.0	(3.9)	(3.4)
Algeria	33	1,314	3.1	22.6	69.9	2,011	1.5	24.1	35.9	1.2	(5.5)	0.5	(5.0)	(3.8)
Canada	32	12,355	1.5	24.2	35.2	23,564	1.3	24.5	32.4	1.8	(0.7)	0.1	(0.6)	1.2
Afghanistan	30	751	3.3	19.5	63.8	667	2.9	21.1	60.6	(0.3)	(1.0)	0.6	(0.4)	(0.7)
Morocco	30	1,121	2.9	22.4	65.3	1,953	1.5	24.0	35.8	1.6	(5.1)	0.5	(4.5)	(2.9)
min	30	368	1.4	19.5	34.0	173	1.2	21.1	30.3	(4.0)	(5.5)	(0.0)	(5.0)	(3.8)
max	1,298	15,209	3.5	24.2	79.4	32,231	2.9	24.6	60.6	5.0	0.2	0.8	0.4	2.1
range	1,268	14,841	2.1	4.7	45.5	32,057	1.6	3.5	30.2	9.0	5.7	0.8	5.5	5.9
Average, unwg.	149	3,890	2.3	22.8	51.5	8,206	1.6	23.8	37.7	1.8	(2.6)	0.3	(2.3)	(0.4)
Average, wg.	636	2,701	2.2	22.8	50.9	6,100	1.5	23.9	36.2	2.8	(2.9)	0.3	(2.5)	0.3
Median	64	1,753	2.3	22.9	53.2	4,626	1.5	24.1	34.9	2.0	(3.0)	0.3	(2.5)	(0.5)
Std Dev	273	4,189	0.6	1.2	12.1	9,011	0.4	0.9	7.7	1.6	1.7	0.2	1.6	1.8
Std Dev, wg.	544	4,164	0.4	0.9	8.4	8,729	0.3	0.6	5.2	1.7	1.3	0.2	1.3	1.5

Notes: c is consumption per-capita obtained from the Penn World Tables 7.1. Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. g^c, g^n, g^T, g^Q, and g, are the annual growth rates of consumption, fertily, life span, quantity of life and welfare, all in consumption equivalent units, according to author's calculations.

Table 5 ---- Welfare Around the World, Benchmark Calibration, 2005

	min	max	range	Average		Median	Standard Deviation	
				unweighted	pop-weighted	Unweighted	unweighted	pop-weigthed
Levels								
c	159	32,231	32,072	7,018	6,023	3,660	7,896	8,526
n	0.87	7.27	6.4	3.19	2.65	2.69	1.58	1.26
T	41.47	81.93	40.5	67.05	68.50	71.04	11.38	8.68
Q(n)	1.20	3.02	1.8	1.69	1.56	1.54	0.40	0.32
Q(T)	20.84	24.58	3.7	23.63	23.81	24.07	0.96	0.70
Q(n,T)	29.48	66.98	37.5	39.72	37.00	37.07	7.90	6.16
∂T/∂n	14.85	93.50	78.7	53.29	53.82	55.39	21.25	17.22
Difference with respect to the U.S.								
c	(32,072)	-	32,072	(25,212)	(26,208)	(28,571)	7,896	8,526
n	(1.18)	5.21	6.39	1.13	0.60	0.64	1.58	1.26
T	(36.27)	4.19	40.46	(10.69)	(9.24)	(6.70)	11.38	8.68
Q(n)	(0.21)	1.61	1.82	0.28	0.14	0.12	0.40	0.32
Q(T)	(3.57)	0.17	3.74	(0.78)	(0.60)	(0.34)	0.96	0.70
Q(n,T)	(5.12)	32.38	37.50	5.13	2.41	2.48	7.90	6.16
∂T/∂n	(58.86)	19.79	78.65	(20.41)	(19.88)	(18.31)	21.25	17.22
Ratios with respect to the U.S.								
c	0.00	1.00	1.00	0.22	0.19	0.11	0.24	0.26
n	0.43	3.54	3.11	1.55	1.29	1.31	0.77	0.61
T	0.53	1.05	0.52	0.86	0.88	0.91	0.15	0.11
Q(n)	0.85	2.13	1.29	1.20	1.10	1.09	0.28	0.22
Q(T)	0.85	1.01	0.15	0.97	0.98	0.99	0.04	0.03
Q(n,T)	0.85	1.94	1.08	1.15	1.07	1.07	0.23	0.18
∂T/∂n	0.20	1.27	1.07	0.72	0.73	0.75	0.29	0.23
Welfare Measures relative to the U.S.								
λ(c)	0.00	1.00	1.00	0.22	0.19	0.11	0.24	0.26
λ(n)	0.65	7.35	6.70	1.80	1.41	1.25	1.28	0.98
λ(T)	0.66	1.02	0.36	0.92	0.94	0.96	0.09	0.07
λ(Q)=λ(n)×λ(T)	0.66	5.69	5.03	1.56	1.27	1.20	0.91	0.69
λ =λ(c)×λ(Q)	0.01	1.00	0.99	0.22	0.18	0.14	0.21	0.24

Notes : c is consumption per-capita obtained from the Penn World Tables 7.1. Total fertility rate (n) and life expectancy at birth (T) are from the World Development Indicators of the World Bank; Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. ∂T/∂n is the value of a child in terms of years of life. λ(c), λ(n), λ(T), λ(Q), and λ, are the ratios of consumption, fertily, life span, quantity of life and welfare relative to the U.S., all in consumption equivalent units, according to author's calculations. Sample includes 142 countries.

Table 6 ---- Welfare Around the World, Most Populated Countries, Benchmark Calibration, 2005

Country Name	Pop 2005 Mill.	c	n	T	Q(n)	Q(T)	Q(n,T)	λ^c	λ^n	λ^T	λ^Q	λ
China	1,298	2,127	1.8	73	1.4	24.2	32.9	0.07	0.90	0.97	0.88	0.06
India	1,091	1,569	2.9	63	1.6	23.5	37.4	0.05	1.35	0.91	1.23	0.06
United States	296	32,231	2.1	78	1.4	24.4	34.6	1.00	1.00	1.00	1.00	1.00
Indonesia	229	2,219	2.3	70	1.5	24.0	35.0	0.07	1.08	0.96	1.03	0.07
Brazil	189	5,962	2.1	72	1.4	24.1	34.3	0.18	1.01	0.97	0.97	0.18
Pakistan	169	1,659	4.2	66	1.9	23.7	44.7	0.05	2.12	0.93	1.96	0.10
Bangladesh	144	882	2.6	65	1.5	23.7	35.8	0.03	1.19	0.92	1.09	0.03
Nigeria	137	1,172	5.7	47	2.3	21.8	50.9	0.04	3.72	0.74	2.77	0.10
Japan	128	20,421	1.3	82	1.3	24.6	31.3	0.63	0.75	1.02	0.77	0.49
Mexico	106	9,152	2.2	74	1.4	24.3	35.1	0.28	1.05	0.98	1.04	0.29
Philippines	90	2,047	3.2	71	1.7	24.1	39.7	0.06	1.49	0.96	1.44	0.09
Vietnam	84	1,369	2.2	74	1.4	24.2	34.8	0.04	1.04	0.98	1.01	0.04
Germany	82	20,643	1.3	79	1.3	24.5	31.5	0.64	0.78	1.01	0.78	0.50
Turkey	73	7,618	2.2	71	1.4	24.1	34.6	0.24	1.04	0.97	1.00	0.24
Egypt, Arab Rep.	73	3,265	3.0	70	1.6	24.0	38.5	0.10	1.39	0.95	1.33	0.13
Iran, Islamic Rep.	72	4,790	1.9	71	1.4	24.1	33.6	0.15	0.96	0.96	0.93	0.14
Thailand	64	4,463	1.8	68	1.4	23.9	32.8	0.14	0.92	0.95	0.87	0.12
France	63	21,590	1.9	80	1.4	24.5	34.1	0.67	0.95	1.01	0.97	0.65
Congo, Dem. Rep.	61	173	6.4	48	2.6	21.9	57.0	0.01	4.98	0.75	3.72	0.02
United Kingdom	60	26,644	1.8	79	1.4	24.5	33.4	0.83	0.91	1.01	0.91	0.76
Italy	59	19,536	1.3	81	1.3	24.5	31.5	0.61	0.77	1.01	0.78	0.47
Korea, Rep.	48	12,222	1.1	78	1.2	24.4	30.3	0.38	0.70	1.00	0.71	0.27
South Africa	47	5,023	2.7	52	1.5	22.4	34.5	0.16	1.24	0.80	0.99	0.15
Spain	44	19,027	1.4	80	1.3	24.5	31.6	0.59	0.78	1.01	0.79	0.46
Colombia	41	4,919	2.5	72	1.5	24.1	36.3	0.15	1.16	0.97	1.13	0.17
Argentina	39	6,893	2.3	75	1.5	24.3	35.5	0.21	1.08	0.99	1.07	0.23
Poland	39	10,016	1.2	75	1.3	24.3	30.8	0.31	0.75	0.99	0.74	0.23
Sudan	38	1,540	4.5	57	2.0	23.0	45.3	0.05	2.37	0.86	2.03	0.10
Tanzania	38	618	5.6	54	2.3	22.6	52.3	0.02	3.62	0.82	2.97	0.06
Kenya	35	1,035	5.0	52	2.1	22.5	47.4	0.03	2.84	0.81	2.29	0.07
Algeria	33	2,011	2.4	72	1.5	24.1	35.9	0.06	1.14	0.97	1.10	0.07
Canada	32	23,564	1.5	80	1.3	24.5	32.4	0.73	0.83	1.01	0.84	0.62
Afghanistan	30	667	7.0	43	2.9	21.1	60.6	0.02	6.41	0.68	4.36	0.09
Morocco	30	1,953	2.4	70	1.5	24.0	35.8	0.06	1.14	0.96	1.09	0.07
Uganda	28	800	6.6	50	2.7	22.2	59.4	0.02	5.33	0.78	4.15	0.10
Peru	27	4,006	2.7	72	1.5	24.2	37.2	0.12	1.25	0.97	1.21	0.15
Nepal	27	799	3.2	65	1.7	23.7	39.2	0.02	1.50	0.93	1.39	0.03
Iraq	26	2,132	4.3	69	1.9	23.9	45.9	0.07	2.22	0.95	2.11	0.14
Malaysia	26	5,053	2.7	74	1.5	24.2	37.4	0.16	1.26	0.98	1.23	0.19
Venezuela, RB	26	4,871	2.7	73	1.5	24.2	37.1	0.15	1.23	0.98	1.20	0.18
Romania	22	6,643	1.3	72	1.3	24.1	31.0	0.21	0.77	0.97	0.75	0.15
Ghana	22	910	4.4	57	1.9	22.9	44.5	0.03	2.29	0.85	1.94	0.05
Australia	20	24,283	1.8	81	1.4	24.5	33.6	0.75	0.91	1.01	0.92	0.70
Mozambique	20	582	5.3	48	2.2	21.9	48.3	0.02	3.21	0.75	2.40	0.04
Sri Lanka	20	2,508	2.4	74	1.5	24.2	35.7	0.08	1.11	0.98	1.09	0.08
Min	20	173	1.1	43	1.2	21.1	30.3	0.01	0.70	0.68	0.71	0.02
Max	1,298	32,231	7.0	82	2.9	24.6	60.6	1.00	6.41	1.02	4.36	1.00
Range	1,278	32,057	5.9	39	1.6	3.5	30.2	0.99	5.70	0.34	3.66	0.98
Average, unweigted	118	7,369	2.91	68	1.6	23.7	38.5	0.23	1.66	0.93	1.44	0.22
Average, pop-weighted	606	6,019	2.54	69	1.5	23.9	36.4	0.19	1.33	0.94	1.20	0.18
median	47	4,006	2.42	72	1.5	24.1	35.7	0.12	1.14	0.97	1.09	0.14
stdev (no weigted)	243	8,579	1.58	11	0.4	0.9	7.8	0.27	1.30	0.09	0.90	0.23
stdev (weighted)	547	8,621	1.14	8	0.3	0.6	5.4	0.27	0.85	0.06	0.60	0.25

Notes : c is consumption per-capita obtained from the Penn World Tables 7.1. Total fertility rate (n) and life expectancy at birth (T) are from the World Development Indicators of World Bank; Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. λ(c), λ(n), λ(T), λ(Q), and λ, are the ratios of consumption, fertily, life span, quantity of life and welfare, all in consumption equivalent units, according to author's calculations.

Table 7 ---- Costs of Raising a Child, 2010 Dollars, r=4.08%

age	year	$(1+r)^{-age}$	Basic Costs (1)	Time cost (2)	College costs (3)	Total
0	2010	1.00	11,950	41,600	-	53,550
1	2011	0.96	11,950	41,600	-	53,550
2	2012	0.92	11,950	41,600	-	53,550
3	2013	0.89	11,980	41,600	-	53,580
4	2014	0.85	11,980	41,600	-	53,580
5	2015	0.82	11,980	41,600	-	53,580
6	2016	0.79	11,880	41,600	-	53,480
7	2017	0.76	11,880	41,600	-	53,480
8	2018	0.73	11,880	41,600	-	53,480
9	2019	0.70	12,660	41,600	-	54,260
10	2020	0.67	12,660	41,600	-	54,260
11	2021	0.64	12,660	41,600	-	54,260
12	2022	0.62	13,340	13,867	-	27,207
13	2023	0.59	13,340	13,867	-	27,207
14	2024	0.57	13,340	13,867	-	27,207
15	2025	0.55	13,830	13,867	-	27,697
16	2026	0.53	13,830	13,867	-	27,697
17	2027	0.51	13,830	13,867	-	27,697
18	2028	0.49	-	-	14,903	14,903
19	2029	0.47	-	-	14,903	14,903
20	2030	0.45	-	-	14,903	14,903
21	2031	0.43	-	-	14,903	14,903
total PV			$ 163,222	$ 451,140	$ 27,353	$ 641,715

(1) Source: USDA "Expenditures on Children by Family", 2010, Table 1. Costs of raising a second child for a middle income family with 2 children. Costs includes housing, food, transportation, health care, clothing, child care, education and miscellaneous goods and services.

(2) Source: Folbre (2008) and author's calculations. Assumes a time investment of 40 hours per week until age 11 and 40/3 hours from ages 12-17 for both parents, and an hourly wage of $20.

(3) Source: College Board (2011). Colleges costs are average in a four-year institution and includes tuition, fees, room and board minus grant aid from all sources, federal education tax credits and other deductions.

Table 8 ---- Quantity of Life in the World, Alternative Calibration, 1970-2005

	min	max	range	Average unweighted	Average pop-weighted	Median Unweighted	Standard Deviation unweighted	Standard Deviation pop-weigthed
1970								
n	1.8	8.2	6.4	5.3	5.3	6.0	1.9	1.5
T	35.0	74.6	39.6	56.8	56.6	55.5	11.2	9.4
Q(n)	1.2	1.5	0.4	1.4	1.4	1.4	0.1	0.1
Q(T)	26.0	39.6	13.6	34.4	34.4	34.3	3.7	3.1
Q(n,T)	36.9	53.6	16.6	46.7	46.8	46.9	3.3	3.0
∂T/∂n	2.3	9.5	7.2	5.2	5.1	4.6	2.0	1.7
2005								
n	0.9	7.3	6.4	3.2	2.7	2.7	1.6	1.3
T	41.5	81.9	40.5	67.0	68.5	71.0	11.4	8.7
Q(n)	1.1	1.5	0.4	1.2	1.2	1.2	0.1	0.1
Q(T)	29.0	41.1	12.1	37.4	37.9	38.8	3.3	2.5
Q(n,T)	36.6	50.4	13.8	46.0	45.5	46.2	2.2	1.4
∂T/∂n	3.0	13.4	10.4	7.7	8.0	8.1	2.8	2.2
Increment, 1970-2005								
n	(5.5)	0.2	5.7	(2.2)	(2.6)	(2.1)	1.3	1.3
T	(13.4)	25.7	39.1	10.3	11.9	9.8	6.2	4.9
Q(n)	(0.3)	0.0	0.3	(0.1)	(0.2)	(0.1)	0.1	0.1
Q(T)	(5.1)	8.5	13.7	3.0	3.5	2.8	2.1	1.7
Q(n,T)	(14.5)	7.1	21.5	(0.7)	(1.3)	(0.7)	3.4	2.9
Growth Rates (%), 1970-2005								
n	(76.2)	3.1	79.3	(40.0)	(48.7)	(41.1)	18.5	18.4
T	(24.4)	59.8	84.2	19.4	22.1	17.1	13.4	11.2
Q(n)	(22.3)	0.9	23.1	(9.4)	(11.6)	(9.4)	5.4	5.3
Q(T)	(15.0)	29.8	44.8	9.3	10.5	8.0	6.9	5.7
Q(n,T)	(28.3)	17.3	45.6	(1.1)	(2.4)	(1.4)	7.3	6.1

Notes : total fertility rate (n) and life expectancy at birth (T) are from the World Development Indicators of the World Bank; Q(T), Q(n) and Q(n,T) are effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. ∂T/∂n is the value of a child in terms of years of life. Sample includes 142 countries.

Table 9 ---- Quantity of Life in the Most Populated Countries, Alternative Calibration, 1970-2005

	POP 2005	1970						2005						Increments					Growth Rates (%)				
Country Name	mill	n	T	Q(n)	Q(T)	Q(n,T)	∂T/∂n	n	T	Q(n)	Q(T)	Q(n,T)	∂T/∂n	n	T	Q(n)	Q(T)	Q(n,T)	n	T	Q(n)	Q(T)	Q(n,T)
China	1,298	5.5	62.0	1.4	36.3	50.0	5.6	1.8	72.6	1.1	39.1	45.0	9.2	(3.8)	10.6	(0.2)	2.8	(5.1)	(68.1)	17.1	(16.5)	7.6	(10.1)
India	1,091	5.5	48.8	1.4	32.0	43.9	3.8	2.9	62.8	1.2	36.6	44.7	6.3	(2.5)	13.9	(0.2)	4.6	0.7	(46.4)	28.6	(11.1)	14.3	1.7
United States	296	2.5	70.8	1.2	38.7	46.2	8.1	2.1	77.7	1.2	40.3	47.1	10.1	(0.4)	6.9	(0.0)	1.6	0.8	(17.2)	9.8	(2.2)	4.1	1.8
Indonesia	229	5.5	47.6	1.4	31.5	43.3	3.6	2.3	69.7	1.2	38.4	45.4	8.0	(3.2)	22.1	(0.2)	6.9	2.1	(58.3)	46.4	(14.0)	21.9	4.9
Brazil	189	5.0	58.6	1.3	35.3	47.6	5.1	2.1	71.6	1.2	38.9	45.5	8.6	(2.9)	13.1	(0.2)	3.6	(2.1)	(58.7)	22.3	(13.2)	10.1	(4.4)
Pakistan	169	7.0	54.3	1.5	33.9	49.8	4.4	4.2	65.6	1.3	37.4	48.5	6.4	(2.7)	11.3	(0.2)	3.4	(1.3)	(39.5)	20.7	(11.5)	10.0	(2.6)
Bangladesh	144	6.9	44.1	1.5	30.1	44.0	3.2	2.6	64.6	1.2	37.1	44.5	6.8	(4.3)	20.5	(0.3)	7.0	0.4	(62.8)	46.5	(18.0)	23.1	1.0
Nigeria	137	6.6	40.4	1.4	28.5	41.2	2.8	5.7	47.2	1.4	31.4	43.6	3.6	(0.9)	6.9	(0.1)	2.9	2.3	(13.8)	17.1	(3.9)	10.0	5.7
Japan	128	2.1	72.0	1.2	39.0	45.7	8.6	1.3	81.9	1.1	41.1	45.9	12.7	(0.9)	10.0	(0.1)	2.2	0.2	(41.0)	13.9	(4.8)	5.5	0.5
Mexico	106	6.7	61.4	1.5	36.2	52.5	5.4	2.2	74.4	1.2	39.6	46.6	9.1	(4.5)	13.1	(0.3)	3.4	(5.9)	(67.2)	21.3	(18.9)	9.4	(11.3)
Philippines	90	6.3	57.2	1.4	34.9	49.7	4.8	3.2	71.0	1.2	38.8	48.0	7.7	(3.0)	13.8	(0.2)	3.9	(1.7)	(48.7)	24.2	(12.9)	11.1	(3.3)
Vietnam	84	7.0	48.9	1.5	32.0	47.1	3.7	2.2	73.7	1.2	39.4	46.3	9.0	(4.9)	24.8	(0.3)	7.4	(0.9)	(69.4)	50.8	(20.2)	23.0	(1.8)
Germany	82	2.0	70.5	1.2	38.6	45.1	8.4	1.3	79.3	1.1	40.6	45.6	11.7	(0.7)	8.8	(0.0)	2.0	0.5	(34.0)	12.6	(3.8)	5.2	1.2
Turkey	73	5.6	55.7	1.4	34.4	47.5	4.6	2.2	71.4	1.2	38.8	45.6	8.5	(3.4)	15.7	(0.2)	4.4	(1.9)	(61.4)	28.2	(15.0)	12.9	(4.0)
Egypt	73	5.9	50.4	1.4	32.6	45.7	3.9	3.0	69.5	1.2	38.4	47.1	7.5	(2.9)	19.1	(0.2)	5.8	1.4	(49.2)	37.9	(12.5)	17.8	3.1
Iran	72	6.6	53.9	1.4	33.8	48.8	4.3	1.9	70.7	1.2	38.7	44.9	8.5	(4.6)	16.7	(0.3)	4.9	(3.9)	(70.4)	31.1	(19.5)	14.4	(7.9)
Thailand	64	5.6	59.4	1.4	35.6	49.1	5.2	1.8	68.4	1.2	38.1	43.9	8.2	(3.8)	9.0	(0.2)	2.5	(5.2)	(67.7)	15.2	(16.5)	7.1	(10.6)
France	63	2.5	72.0	1.2	39.0	46.6	8.3	1.9	80.2	1.2	40.8	47.3	10.9	(0.6)	8.2	(0.0)	1.8	0.7	(22.7)	11.4	(2.9)	4.6	1.6
Congo	61	6.2	43.8	1.4	30.0	42.6	3.2	6.4	47.6	1.4	31.5	45.1	3.6	0.2	3.8	0.0	1.5	2.6	3.1	8.8	0.9	5.1	6.0
United Kingdom	60	2.4	72.0	1.2	39.0	46.5	8.4	1.8	79.1	1.2	40.6	46.7	10.8	(0.7)	7.1	(0.0)	1.6	0.2	(27.0)	9.9	(3.4)	4.0	0.5
Italy	59	2.4	71.6	1.2	38.9	46.3	8.3	1.3	80.8	1.1	40.9	45.9	12.2	(1.1)	9.2	(0.1)	2.0	(0.5)	(45.6)	12.8	(5.9)	5.2	(1.0)
Korea, Rep.	48	4.5	61.2	1.3	36.1	47.6	5.6	1.1	78.4	1.1	40.4	44.7	12.2	(3.5)	17.2	(0.2)	4.3	(2.9)	(76.2)	28.1	(16.1)	11.9	(6.2)
South Africa	47	5.6	52.8	1.4	33.4	46.2	4.3	2.7	51.8	1.2	33.1	39.9	4.7	(2.9)	(1.1)	(0.2)	(0.4)	(6.3)	(52.0)	(2.0)	(12.6)	(1.1)	(13.6)
Spain	44	2.8	72.0	1.2	39.0	47.4	8.1	1.4	80.2	1.1	40.8	45.8	12.0	(1.5)	8.2	(0.1)	1.8	(1.6)	(52.4)	11.4	(7.6)	4.6	(3.4)
Colombia	41	5.6	60.9	1.4	36.0	49.8	5.4	2.5	72.3	1.2	39.0	46.7	8.4	(3.1)	11.4	(0.2)	3.0	(3.1)	(55.4)	18.7	(13.5)	8.4	(6.2)
Argentina	39	3.1	66.6	1.2	37.6	46.3	6.9	2.3	74.8	1.2	39.6	46.9	9.1	(0.8)	8.2	(0.0)	2.0	0.6	(25.5)	12.3	(3.9)	5.3	1.2
Poland	39	2.2	69.9	1.2	38.5	45.3	8.1	1.2	74.9	1.1	39.7	44.3	10.7	(1.0)	5.1	(0.1)	1.2	(1.0)	(43.6)	7.3	(5.2)	3.1	(2.3)
Sudan	38	6.6	46.4	1.4	31.0	44.8	3.4	4.5	57.3	1.3	34.9	46.0	5.0	(2.1)	10.9	(0.1)	3.9	1.1	(31.6)	23.5	(8.9)	12.5	2.5
Tanzania	38	6.8	46.7	1.5	31.2	45.3	3.5	5.6	53.6	1.4	33.7	46.6	4.4	(1.1)	6.9	(0.1)	2.5	1.3	(16.8)	14.9	(4.9)	8.2	2.9
Kenya	35	8.1	52.2	1.5	33.2	51.2	4.1	5.0	52.4	1.3	33.3	44.8	4.3	(3.1)	0.2	(0.2)	0.1	(6.4)	(38.1)	0.4	(12.6)	0.2	(12.4)
Algeria	33	7.4	52.9	1.5	33.5	50.0	4.2	2.4	71.6	1.2	38.9	46.4	8.3	(5.0)	18.7	(0.3)	5.4	(3.7)	(67.1)	35.4	(20.3)	16.2	(7.4)
Canada	32	2.3	72.7	1.2	39.1	46.2	8.7	1.5	80.3	1.1	40.8	46.3	11.6	(0.7)	7.6	(0.0)	1.7	0.1	(31.8)	10.4	(3.8)	4.2	0.2
Afghanistan	30	7.7	35.0	1.5	26.0	39.4	2.3	7.0	42.9	1.5	29.6	43.5	3.0	(0.7)	7.9	(0.0)	3.6	4.1	(9.4)	22.4	(3.1)	13.8	10.3
Morocco	30	7.1	51.6	1.5	33.0	48.6	4.0	2.4	70.4	1.2	38.6	46.0	8.1	(4.6)	18.8	(0.3)	5.6	(2.7)	(65.7)	36.5	(19.2)	17.0	(5.5)
min	30	2.0	35.0	1.2	26.0	39.4	2.3	1.1	42.9	1.1	29.6	39.9	3.0	(5.0)	(1.1)	(0.3)	(0.4)	(6.4)	(76.2)	(2.0)	(20.3)	(1.1)	(13.6)
max	1,298	8.1	72.7	1.5	39.1	52.5	8.7	7.0	81.9	1.5	41.1	48.5	12.7	0.2	24.8	0.0	7.4	4.1	3.1	50.8	0.9	23.1	10.3
range	1,268	6.1	37.7	0.4	13.1	13.1	6.4	5.9	39.0	0.4	11.5	8.6	9.7	5.2	25.9	0.3	7.8	10.4	79.3	52.8	21.2	24.3	23.9
Average, unw.	149	5.2	57.5	1.4	34.6	46.7	5.4	2.8	68.8	1.2	37.9	45.6	8.3	(2.4)	11.3	(0.1)	3.3	(1.1)	(45.0)	20.8	(10.5)	9.7	(2.0)
Average, weig.	636	5.2	56.9	1.4	34.5	46.8	5.1	2.5	69.1	1.2	38.1	45.4	8.2	(2.7)	12.2	(0.2)	3.6	(1.5)	(50.7)	22.5	(12.0)	10.6	(2.8)
Median	64	5.6	56.5	1.4	34.7	46.4	4.7	2.2	71.5	1.2	38.9	45.8	8.4	(2.8)	10.3	(0.2)	2.9	(0.7)	(47.5)	17.9	(12.0)	8.9	(1.4)
Std Dev	273	1.9	10.7	0.1	3.5	2.8	2.0	1.6	10.8	0.1	3.1	1.6	2.8	1.5	6.0	0.1	1.9	2.7	20.4	12.8	6.3	6.2	5.7
Std Dev, weig.	544	1.4	9.0	0.1	2.9	2.9	1.6	1.1	7.9	0.1	2.2	1.2	2.1	1.3	4.5	0.1	1.6	2.8	17.8	10.7	5.2	5.3	5.8

Notes: total fertility rate (n) and life expectancy at birth (T) are from the World Development Indicators of the World Bank; Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. ∂T/∂n is the value of a child in terms of years of life.

Table 10 ---- Evolution of Welfare Around the World, Alternative Calibration, 1970-2005

	min	max	range	Average		Median	Standard Deviation	
				unweighted	pop-weighted	Unweighted	unweighted	pop-weigthed
1970								
c	169	15,972	15,802	3,555	2,742	1,645	3,858	4,087
Q(n)	1.2	1.5	0.4	1.4	1.4	1.4	0.1	0.1
Q(T)	26.0	39.6	13.6	34.4	34.4	34.3	3.7	3.1
Q(n,T)	36.9	53.6	16.6	46.7	46.8	46.9	3.3	3.0
2005								
c	159	32,231	32,072	7,018	6,023	3,660	7,896	8,526
Q(n)	1.1	1.5	0.4	1.2	1.2	1.2	0.1	0.1
Q(T)	29.0	41.1	12.1	37.4	37.9	38.8	3.3	2.5
Q(n,T)	36.6	50.4	13.8	46.0	45.5	46.2	2.2	1.4
Annual Growth Rates of Welfare Measures in Consumption Equivalent Units (%)								
g^c	(4.3)	5.6	9.9	1.5	2.6	1.6	1.7	1.8
g^n	(2.3)	0.1	2.4	(0.9)	(1.1)	(0.9)	0.5	0.5
g^T	(1.5)	2.4	3.9	0.8	0.9	0.7	0.6	0.5
$g^Q = g^n+g^T$	(3.1)	1.5	4.5	(0.1)	(0.2)	(0.1)	0.7	0.6
$g = g^c+g^Q$	(3.4)	6.0	9.4	1.4	2.4	1.5	1.7	1.5

Notes: c is consumption per-capita obtained from the Penn World Tables 7.1. Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. g^c, g^n, g^T, g^Q, and g, are the annual growth rates of consumption, fertily, life span, quantity of life and welfare, all in consumption equivalent units, according to author's calculations.

Table 11 ---- Evolution of Welfare, Most Populated Countries, Alternative Calibration, 1970-2005

	POP 2005	1970				2005				Annual Growth Rates of Welfare (%)				
Country Name	mill	c	Q(n)	Q(T)	Q(n,T)	c	Q(n)	Q(T)	Q(n,T)	g^c	g^n	g^T	g^Q	g
China	1,298	368	1.4	36.3	50.0	2,127	1.1	39.1	45.0	5.0	(1.7)	0.68	(1.0)	4.0
India	1,091	652	1.4	32.0	43.9	1,569	1.2	36.6	44.7	2.5	(1.1)	1.2	0.2	2.7
United States	296	15,209	1.2	38.7	46.2	32,231	1.2	40.3	47.1	2.1	(0.2)	0.4	0.2	2.3
Indonesia	229	438	1.4	31.5	43.3	2,219	1.2	38.4	45.4	4.6	(1.4)	1.8	0.4	5.1
Brazil	189	3,160	1.3	35.3	47.6	5,962	1.2	38.9	45.5	1.8	(1.3)	0.9	(0.4)	1.4
Pakistan	169	928	1.5	33.9	49.8	1,659	1.3	37.4	48.5	1.7	(1.1)	0.9	(0.2)	1.4
Bangladesh	144	814	1.5	30.1	44.0	882	1.2	37.1	44.5	0.2	(1.8)	1.9	0.1	0.3
Nigeria	137	1,239	1.4	28.5	41.2	1,172	1.4	31.4	43.6	(0.2)	(0.4)	0.9	0.5	0.4
Japan	128	8,601	1.2	39.0	45.7	20,421	1.1	41.1	45.9	2.5	(0.5)	0.5	0.0	2.5
Mexico	106	4,990	1.5	36.2	52.5	9,152	1.2	39.6	46.6	1.7	(1.9)	0.8	(1.1)	0.6
Philippines	90	1,278	1.4	34.9	49.7	2,047	1.2	38.8	48.0	1.3	(1.3)	1.0	(0.3)	1.0
Vietnam	84	494	1.5	32.0	47.1	1,369	1.2	39.4	46.3	2.9	(2.1)	1.9	(0.2)	2.7
Germany	82	10,204	1.2	38.6	45.1	20,643	1.1	40.6	45.6	2.0	(0.4)	0.5	0.1	2.1
Turkey	73	3,698	1.4	34.4	47.5	7,618	1.2	38.8	45.6	2.1	(1.5)	1.1	(0.4)	1.7
Egypt	73	1,312	1.4	32.6	45.7	3,265	1.2	38.4	47.1	2.6	(1.2)	1.5	0.3	2.9
Iran	72	2,192	1.4	33.8	48.8	4,790	1.2	38.7	44.9	2.2	(2.0)	1.2	(0.8)	1.5
Thailand	64	1,201	1.4	35.6	49.1	4,463	1.2	38.1	43.9	3.8	(1.7)	0.6	(1.0)	2.7
France	63	10,573	1.2	39.0	46.6	21,590	1.2	40.8	47.3	2.0	(0.3)	0.4	0.1	2.2
Congo	61	692	1.4	30.0	42.6	173	1.4	31.5	45.1	(4.0)	0.1	0.5	0.5	(3.4)
United Kingdom	60	11,467	1.2	39.0	46.5	26,644	1.2	40.6	46.7	2.4	(0.3)	0.4	0.0	2.5
Italy	59	9,376	1.2	38.9	46.3	19,536	1.1	40.9	45.9	2.1	(0.6)	0.5	(0.1)	2.0
Korea, Rep.	48	2,227	1.3	36.1	47.6	12,222	1.1	40.4	44.7	4.9	(1.6)	1.0	(0.6)	4.3
South Africa	47	3,276	1.4	33.4	46.2	5,023	1.2	33.1	39.9	1.2	(1.2)	(0.1)	(1.3)	(0.1)
Spain	44	8,089	1.2	39.0	47.4	19,027	1.1	40.8	45.8	2.4	(0.7)	0.4	(0.3)	2.1
Colombia	41	2,302	1.4	36.0	49.8	4,919	1.2	39.0	46.7	2.2	(1.3)	0.7	(0.6)	1.6
Argentina	39	5,064	1.2	37.6	46.3	6,893	1.2	39.6	46.9	0.9	(0.4)	0.5	0.1	1.0
Poland	39	4,441	1.2	38.5	45.3	10,016	1.1	39.7	44.3	2.3	(0.5)	0.3	(0.2)	2.1
Sudan	38	1,100	1.4	31.0	44.8	1,540	1.3	34.9	46.0	1.0	(0.9)	1.1	0.2	1.2
Tanzania	38	469	1.5	31.2	45.3	618	1.4	33.7	46.6	0.8	(0.5)	0.7	0.3	1.1
Kenya	35	859	1.5	33.2	51.2	1,035	1.3	33.3	44.8	0.5	(1.2)	0.0	(1.2)	(0.7)
Algeria	33	1,314	1.5	33.5	50.0	2,011	1.2	38.9	46.4	1.2	(2.1)	1.4	(0.7)	0.5
Canada	32	12,355	1.2	39.1	46.2	23,564	1.1	40.8	46.3	1.8	(0.4)	0.4	0.0	1.9
Afghanistan	30	751	1.5	26.0	39.4	667	1.5	29.6	43.5	(0.3)	(0.3)	1.2	0.9	0.6
Morocco	30	1,121	1.5	33.0	48.6	1,953	1.2	38.6	46.0	1.6	(2.0)	1.4	(0.5)	1.1
min	30	368	1.2	26.0	39.4	173	1.1	29.6	39.9	(4.0)	(2.1)	(0.1)	(1.3)	(3.4)
max	1,298	15,209	1.5	39.1	52.5	32,231	1.5	41.1	48.5	5.0	0.1	1.9	0.9	5.1
range	1,268	14,841	0.4	13.1	13.1	32,057	0.4	11.5	8.6	9.0	2.2	2.0	2.2	8.5
Average, unwg.	149	3,890	1.4	34.6	46.7	8,206	1.2	37.9	45.6	1.8	(1.0)	0.8	(0.2)	1.6
Average, wg.	636	2,701	1.4	34.5	46.8	6,100	1.2	38.1	45.4	2.8	(1.2)	0.9	(0.3)	2.6
Median	64	1,753	1.4	34.7	46.4	4,626	1.2	38.9	45.8	2.0	(1.2)	0.8	(0.1)	1.6
Std Dev	273	4,189	0.1	3.5	2.8	9,011	0.1	3.1	1.6	1.6	0.6	0.5	0.5	1.5
Std Dev, wg.	544	4,164	0.1	2.9	2.9	8,729	0.1	2.2	1.2	1.7	0.5	0.4	0.5	1.4

Notes: c is consumption per-capita obtained from the Penn World Tables 7.1. Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. g^c, g^n, g^T, g^Q, and g, are the annual growth rates of consumption, fertily, life span, quantity of life and welfare, all in consumption equivalent units, according to author's calculations.

Table 12 ---- Welfare Around the World, Alternative Calibration, 2005

	min	max	range	Average		Median	Standard Deviation	
				unweighted	pop-weighted	Unweighted	unweighted	pop-weigthed
Levels								
c	159	32,231	32,072	7,018	6,023	3,660	7,896	8,526
n	0.87	7.27	6.4	3.19	2.65	2.69	1.58	1.26
T	41.47	81.93	40.5	67.05	68.50	71.04	11.38	8.68
Q(n)	1.09	1.49	0.4	1.24	1.20	1.21	0.10	0.08
Q(T)	29.00	41.13	12.1	37.39	37.92	38.75	3.28	2.45
Q(n,T)	36.60	50.39	13.8	45.97	45.50	46.24	2.22	1.42
∂T/∂n	3.05	13.41	10.4	7.68	8.02	8.10	2.75	2.22
Difference with respect to the U.S.								
c	(32,072)	-	32,072	(25,212)	(26,208)	(28,571)	7,896	8,526
n	(1.18)	5.21	6.39	1.13	0.60	0.64	1.58	1.26
T	(36.27)	4.19	40.46	(10.69)	(9.24)	(6.70)	11.38	8.68
Q(n)	(0.08)	0.32	0.40	0.07	0.04	0.04	0.10	0.08
Q(T)	(11.27)	0.85	12.12	(2.88)	(2.35)	(1.52)	3.28	2.45
Q(n,T)	(10.45)	3.34	13.78	(1.09)	(1.55)	(0.81)	2.22	1.42
∂T/∂n	(7.05)	3.32	10.36	(2.42)	(2.08)	(2.00)	2.75	2.22
Ratios with respect to the U.S.								
c	0.00	1.00	1.00	0.22	0.19	0.11	0.24	0.26
n	0.43	3.54	3.11	1.55	1.29	1.31	0.77	0.61
T	0.53	1.05	0.52	0.86	0.88	0.91	0.15	0.11
Q(n)	0.93	1.27	0.34	1.06	1.03	1.03	0.08	0.07
Q(T)	0.72	1.02	0.30	0.93	0.94	0.96	0.08	0.06
Q(n,T)	0.78	1.07	0.29	0.98	0.97	0.98	0.05	0.03
∂T/∂n	0.30	1.33	1.03	0.76	0.79	0.80	0.27	0.22
Welfare Measures relative to the U.S.								
λ(c)	0.00	1.00	1.00	0.22	0.19	0.11	0.24	0.26
λ(n)	0.80	2.17	1.37	1.23	1.12	1.11	0.32	0.25
λ(T)	0.35	1.07	0.72	0.81	0.84	0.88	0.21	0.16
λ(Q)=λ(n)×λ(T)	0.45	1.25	0.80	0.94	0.90	0.95	0.14	0.09
λ =λ(c)×λ(Q)	0.00	1.00	1.00	0.21	0.18	0.10	0.24	0.26

Notes : c is consumption per-capita obtained from the Penn World Tables 7.1. Total fertility rate (n) and life expectancy at birth (T) are from the World Development Indicators of the World Bank; Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. ∂T/∂n is the value of a child in terms of years of life. λ(c), λ(n), λ(T), λ(Q), and λ, are the ratios of consumption, fertily, life span, quantity of life and welfare relative to the U.S., all in consumption equivalent units, according to author's calculations. Sample includes 142 countries.

Table 13 ---- Welfare Around the World, Most Populated Countries, Alternative Calibration, 2005

Country Name	Pop 2005 Mill.	c	n	T	Q(n)	Q(T)	Q(n,T)	λ^c	λ^n	λ^T	λ^Q	λ
China	1,298	2,127	1.8	73	1.1	39.1	45.0	0.07	0.95	0.91	0.87	0.06
India	1,091	1,569	2.9	63	1.2	36.6	44.7	0.05	1.15	0.73	0.85	0.04
United States	296	32,231	2.1	78	1.2	40.3	47.1	1.00	1.00	1.00	1.00	1.00
Indonesia	229	2,219	2.3	70	1.2	38.4	45.4	0.07	1.04	0.86	0.89	0.06
Brazil	189	5,962	2.1	72	1.2	38.9	45.5	0.18	1.00	0.89	0.90	0.17
Pakistan	169	1,659	4.2	66	1.3	37.4	48.5	0.05	1.40	0.78	1.10	0.06
Bangladesh	144	882	2.6	65	1.2	37.1	44.5	0.03	1.09	0.77	0.83	0.02
Nigeria	137	1,172	5.7	47	1.4	31.4	43.6	0.04	1.74	0.45	0.78	0.03
Japan	128	20,421	1.3	82	1.1	41.1	45.9	0.63	0.87	1.07	0.93	0.59
Mexico	106	9,152	2.2	74	1.2	39.6	46.6	0.28	1.03	0.94	0.97	0.27
Philippines	90	2,047	3.2	71	1.2	38.8	48.0	0.06	1.21	0.88	1.07	0.07
Vietnam	84	1,369	2.2	74	1.2	39.4	46.3	0.04	1.02	0.93	0.95	0.04
Germany	82	20,643	1.3	79	1.1	40.6	45.6	0.64	0.88	1.03	0.90	0.58
Turkey	73	7,618	2.2	71	1.2	38.8	45.6	0.24	1.02	0.89	0.91	0.21
Egypt, Arab Rep.	73	3,265	3.0	70	1.2	38.4	47.1	0.10	1.17	0.86	1.00	0.10
Iran, Islamic Rep.	72	4,790	1.9	71	1.2	38.7	44.9	0.15	0.98	0.88	0.86	0.13
Thailand	64	4,463	1.8	68	1.2	38.1	43.9	0.14	0.96	0.84	0.80	0.11
France	63	21,590	1.9	80	1.2	40.8	47.3	0.67	0.98	1.04	1.02	0.68
Congo, Dem. Rep.	61	173	6.4	48	1.4	31.5	45.1	0.01	1.92	0.45	0.87	0.00
United Kingdom	60	26,644	1.8	79	1.2	40.6	46.7	0.83	0.95	1.02	0.97	0.81
Italy	59	19,536	1.3	81	1.1	40.9	45.9	0.61	0.88	1.05	0.92	0.56
Korea, Rep.	48	12,222	1.1	78	1.1	40.4	44.7	0.38	0.84	1.01	0.85	0.32
South Africa	47	5,023	2.7	52	1.2	33.1	39.9	0.16	1.11	0.53	0.59	0.09
Spain	44	19,027	1.4	80	1.1	40.8	45.8	0.59	0.88	1.04	0.92	0.54
Colombia	41	4,919	2.5	72	1.2	39.0	46.7	0.15	1.08	0.91	0.97	0.15
Argentina	39	6,893	2.3	75	1.2	39.6	46.9	0.21	1.04	0.95	0.99	0.21
Poland	39	10,016	1.2	75	1.1	39.7	44.3	0.31	0.86	0.95	0.82	0.26
Sudan	38	1,540	4.5	57	1.3	34.9	46.0	0.05	1.47	0.63	0.93	0.04
Tanzania	38	618	5.6	54	1.4	33.7	46.6	0.02	1.72	0.56	0.97	0.02
Kenya	35	1,035	5.0	52	1.3	33.3	44.8	0.03	1.58	0.54	0.85	0.03
Algeria	33	2,011	2.4	72	1.2	38.9	46.4	0.06	1.07	0.89	0.95	0.06
Canada	32	23,564	1.5	80	1.1	40.8	46.3	0.73	0.91	1.04	0.95	0.70
Afghanistan	30	667	7.0	43	1.5	29.6	43.5	0.02	2.08	0.37	0.78	0.02
Morocco	30	1,953	2.4	70	1.2	38.6	46.0	0.06	1.06	0.87	0.93	0.06
Uganda	28	800	6.6	50	1.4	32.5	46.8	0.02	1.97	0.50	0.99	0.02
Peru	27	4,006	2.7	72	1.2	39.1	47.2	0.12	1.11	0.91	1.01	0.13
Nepal	27	799	3.2	65	1.2	37.3	46.2	0.02	1.21	0.78	0.94	0.02
Iraq	26	2,132	4.3	69	1.3	38.1	49.8	0.07	1.43	0.84	1.20	0.08
Malaysia	26	5,053	2.7	74	1.2	39.4	47.6	0.16	1.12	0.93	1.04	0.16
Venezuela, RB	26	4,871	2.7	73	1.2	39.3	47.3	0.15	1.10	0.92	1.02	0.15
Romania	22	6,643	1.3	72	1.1	39.0	43.7	0.21	0.88	0.90	0.79	0.16
Ghana	22	910	4.4	57	1.3	34.7	45.5	0.03	1.45	0.62	0.89	0.03
Australia	20	24,283	1.8	81	1.2	40.9	47.1	0.75	0.96	1.05	1.00	0.76
Mozambique	20	582	5.3	48	1.4	31.5	43.0	0.02	1.65	0.45	0.75	0.01
Sri Lanka	20	2,508	2.4	74	1.2	39.4	46.7	0.08	1.05	0.93	0.98	0.08
Min	20	173	1.1	43	1.1	29.6	39.9	0.01	0.84	0.37	0.59	0.00
Max	1,298	32,231	7.0	82	1.5	41.1	49.8	1.00	2.08	1.07	1.20	1.00
Range	1,278	32,057	5.9	39	0.4	11.5	9.9	0.99	1.25	0.70	0.61	1.00
Average, unweigted	118	7,369	2.91	68	1.2	37.8	45.8	0.23	1.17	0.83	0.92	0.22
Average, pop-weighted	606	6,019	2.54	69	1.2	38.1	45.4	0.19	1.10	0.84	0.90	0.18
median	47	4,006	2.42	72	1.2	38.9	46.0	0.12	1.06	0.89	0.93	0.10
stdev (no weigted)	243	8,579	1.58	11	0.1	3.1	1.7	0.27	0.32	0.19	0.10	0.26
stdev (weighted)	547	8,621	1.14	8	0.1	2.2	1.3	0.27	0.23	0.14	0.08	0.26

Notes : c is consumption per-capita obtained from the Penn World Tables 7.1. Total fertility rate (n) and life expectancy at birth (T) are from the World Development Indicators of World Bank; Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. λ(c), λ(n), λ(T), λ(Q), and λ, are the ratios of consumption, fertily, life span, quantity of life and welfare, all in consumption equivalent units, according to author's calculations.

Table 14 ---- Evolution of Welfare Around the World, Age 5 Calibration, 1970-2005

	min	max	range	Average		Median	Standard Deviation	
				unweighted	pop-weighted	Unweighted	unweighted	pop-weigthed
1970								
c	169	15,972	15,802	3,642	2,787	1,643	4,030	4,158
Q(n)	1.2	1.5	0.3	1.3	1.3	1.3	0.1	0.1
Q(T)	30.9	38.7	7.8	35.7	35.8	35.9	2.0	1.8
Q(n,T)	41.7	51.9	10.1	46.8	46.9	46.2	2.5	2.5
2005								
c	159	32,231	32,072	7,094	6,091	3,503	8,217	8,656
Q(n)	1.1	1.4	0.3	1.2	1.2	1.2	0.1	0.1
Q(T)	28.8	40.2	11.3	37.1	37.6	38.0	2.5	1.8
Q(n,T)	35.8	49.5	13.7	45.2	44.8	45.5	2.1	1.3
Annual Growth Rates of Welfare Measures in Consumption Equivalent Units (%)								
g^c	(4.3)	5.6	9.9	1.5	2.6	1.6	1.6	1.8
g^n	(1.7)	0.5	2.1	(0.7)	(0.9)	(0.7)	0.5	0.5
g^T	(1.8)	1.3	3.1	0.4	0.5	0.4	0.4	0.3
$g^Q = g^n + g^T$	(3.1)	0.8	3.9	(0.3)	(0.4)	(0.3)	0.6	0.5
$g = g^c + g^Q$	(3.8)	5.6	9.5	1.2	2.2	1.3	1.6	1.5

Notes: c is consumption per-capita obtained from the Penn World Tables 7.1. Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. g^c, g^n, g^T, g^Q, and g, are the annual growth rates of consumption, fertily, life span, quantity of life and full consumption all in consumption equivalent units according to author's calculations.